AN ANALYSIS OF THE BILATERAL COMMODITY FLOWS BETWEEN TAIWAN & JAPAN IN THE LIGHT OF THE PRODUCT CYCLE MODEL

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CHAPTER I: INTRODUCTION

The problem of how to successfully develop and ultimately modernize the more than a hundred developing countries, which contain two-thirds of the world's total population but are generally poor and backward, is no doubt a main theme in economic studies nowadays as well as in the foreseeable future. Among various means to achieve such a goal, international trade, especially free trade[1], is believed to be a very contributive policy. Indeed, since Marshall's suggestion that "the causes of economic development must seek in international trade"[2], international trade has long been viewed as "an engine of growth"[3]. By means of international trade, and hence through international specialization and division of labor, a country can have better opportunities in production and exchange. This in turn leads to an increase in the employment of a country's natural and human resources as well as their more efficient utilization. In fact, experiences of the positive role of international trade in economic development have widely been observed.

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[1] Trade in which goods are imported and exported without barriers in form of tariffs, quantitative quotas or any other kind of restrictions.

[2] Alfred Marshall, Industry and Trade, London: Macmillan, (1920), p.9.

[3] D.H. Robertson, Essays in Monetary Theory, London: Staple, 1956, p. 214.

In spite of these inter-relationships between international trade and economic development, however, discussions on international trade in economics are traditionally in the light of comparative static models. Both the Classical Trade Theory of Comparative Cost[4] and the Neo-classical Trade Theory of Factor Endowment[5] are based on a 2 x 2 x 2 structure[6] in analysing trade phenomenon. These models provide a "timeless cross-section view" of comparative advantage[7] but fail to take into account the dynamic elements.

Aside from this theoretical consideration, the traditional trade models have also found to be inadequate to provide explanations to some trade phenomena nowadays. Thus, these models are even more unlikely to revealed the process of economic development concerned. For instance, according to the Neo-classical Theory, those labor abundant countries should produce and export labor-intensive commodities. How-

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[4] Based on the Labor Theory of Value, the Classical Trade Theory of Comparative Costs suggests: A country exports products with relatively low domestic labor requirements, i.e. goods for which it has a high labor productivity (output per unit of labor) relative to other goods. Conversely, a country imports commodities in which its average labor productivity is relatively low.

[5] The Neoclassical Trade Theory of Factor Endowments suggests: A country that is well endowed with capital will export capital-intensive goods and correspondingly will import labor-intensive goods.

[6] i.e., an analytical framework of two countries, two factors of production (labor, capital) and two commodities.

[7] Gottfreid Haberler, "International Trade and Economic Development", in James D. Theberge ed., Economics of Trade and Development, New York: John Wiley & Sons Co., 1968, p.105.

ever, viewing the experience of say, Japan, through her process of industrialization, this rather labor abundant country, has develop her capital-intensive industries quite well, and had acquired comparative advantage in those capital-intensive commodities like iron & steel products, transportation equipments, etc.[8] Obviously, this cannot be adequately explained by the traditional theories.

Secondly, it is found that in many countries their present exportables were those initially imported commodities. This implies that some countries may gradually acquire comparative advantage in those commodities which they were in a comparatively disadvantageous position initially. Conversely, a country which initially possessed comparative advantage in some commodities will, after some time, deteriorate in its position.

Moreover, there is the famous Leontief Paradox[9]: In measuring and comparing the factor intensities of U.S. exports and imports, Leontief found out that the capital-abundant U.S. did export labor-intensive commodities and import capital-intensive commodities. This again is not in accordance with

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[8] Seev Hirsch, "Hypotheses Regarding Trade Between Developing and Industrial Countries", in International Division of Labor: Problem & Perspectives. J.C.B. Mohr (Paul Siebeck) Tubirgen, 1974, pp. 65-82.

[9] W.W. Leontief, "Domestic Production and Foreign Trade: The American Capital Position Re-examined", Economic Internazionale, Feb. 1954, pp. 9-38.

what the traditional theories postulate.

Indeed, in order that changes in trade patterns over time as well as the role of trade in economic development can be revealed, dynamic elements should be incorporated into trade theory so as to provide the appropriate link between trade performance and development process. In fact, many recently developed trade hypotheses such as the Product Cycle Theory[10], the Technological Gap Theory[11], the Dynamic Comparative Advantage Theory[12] etc., do take assiduous efforts in this aspect. Each new approach is designed to remove or at least mitigate one or more of the shortcomings in the traditional theories and to provide explanations to the phenomenon of the changing pattern of international comparative advantage[13]. Their critical argument is: Although traditional trade theories can describe the cause and patterns of trade flows at given moments of time, say, at t_0 and t_1

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10 Product Cycle Theory was developed by Raymond Vernon, Seev Hirsch, Louis T. Wells Jr., Gary Hufbauer, William Gruber, Dileep Mehta as well as Michael Posner etc.

11 Developed by I.B. Kravis in 1950 along with Balogh and Williams, Authors like M. Posner, Freeman, Douglass and G. Hufbauer are often credited with the "Technological Gap" explanation of trade flows.

12 Roger W. Klein, "A Dynamic Theory of Comparative Advantage", American Economic Review, Vol. 63, 1973, pp. 173-184.

13 This was pointed out by Hal B. Lary, "Changing Patterns of International Comparative Advantage", National Bureau of Economic Research, 1969, pp. 27-36.

(actually, the time lag concerned may be of many years), yet the continuous change in comparative advantage between these two static moments cannot be revealed by the traditional analyses. Precisely speaking, over time, a country's proportion of factor endowments may change and her technologies of production may improve. Also, over time, a country's income and consumption taste may change as well, and this will lead to an alteration of her domestic consumption demands. As a whole, the volume and pattern of trade flows will be changed.

These dynamic changes, however, should be revealed in the trade flows experiences of individual or groups of commodities that have actually taken place. Indeed, the main interest of this study is to present empirical evidence for the existence of product cycle trade[14] in some commodities and to investigate their actual processes of [illegible] since our real world is of a multi-country version, it is too complicated for us to undertake a thorough investigation. Instead, in the present study, we shall conduct analyses in a framework of two countries, three factors of production (other than labor and capital, we add in the factor of technology progress) and multi-commodity, i.e., forming a 2 x 3 x n model.

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[14] The term "Product Cycle Trade" will be elaborated later in the course of this study.

It is expected that, through our study, we can draw some generalizations and/or implications about the Product Cycle Model in explaining the patterns of commodity trade flows nowadays. Our work will start with a discussion on the traditional trade theories in the next chapter. Then, the Product Cycle Model will be presented as a guide-line to the analyses that follow. Before conducting our empirical investigations, the economic situations of our bilateral trade patterns, Taiwan and Japan, will be briefly considered in Chapter Three. And, in order to facilitate the analyses of trade flows within a bilateral case in particular, a suggested approach will be introduced. In Chapter Four and Five, following this suggested approach, the bilateral commodity flows analyses will be conducted initially at a SITC One-Digit level[15] with inter-Industry trade data to provide an overall picture of the circumstance. This will be followed by more detailed examination at the Three-Digit Level Inter-industry trade data and Four- to Five-Digit Levels Intra-industry trade data in the hope to exhibit some features of product cycle trade. Besides, in order that our findings may eventually be concluded within the comparative Advantage context, the "Revealed Comparative Advantage" method[16] will be employed as a supplementary analysis to

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[15] Standard International Trade Classification.

[16] Bela Balassa, "Trade Liberalisation and Revealed Comparative Advantage", Manchester School of Economic & Social Studies, 1965, pp. 99-117.

product cycle trade. Since the role played by foreign investment nowadays is closely related to international trade, we shall inspect the particulars of foreign investments in relation to our bilateral trade flow study, i.e., Japanese investments in Taiwan's manufacturing industries, in order to find out whether there is any inter-relationship between the rise of product cycle trade and of foreign investments. This will be done in Chapter Six. And finally, upon summarizing our empirical findings, some generalizations and/or implications will be presented in the concluding Chapter of this thesis.

CHAPTER II: THEORETICAL REVIEW

2.1 The Accepted Theory in International Trade

The causes and patterns of world trade flows have been extensively elaborated by traditional trade theories. These include A. Smith's Absolute Advantage Theory, D. Ricardo's Law of Comparative Advantage, as well as the stream of trade theories developed by the Neo-classical economists. We do not intend to review the whole set of these theories. Instead, we shall concentrate on the Factor Proportion Theory of Heckscher-Ohlin, which represents the main-stream of the traditional trade theories and has been widely accepted in analysing international trade.

Under the basic assumptions of free trade and that all countries have an identical production function (i.e., same technological possibilities) for any given industry, the Heckscher-Ohlin Theory identifies that different factor intensities in different products (say, a commodity X, requires in its production a lot of capital inputs relative to labor, whereas another commodity, say Y, requires a lot of labor inputs relative to capital, thus, we have capital-intensive and labor-intensive commodities), along with the difference in relative factor endowments among countries (i.e., a country may possess a lot of capital relative to the other factors of production[1]; whereas another country may possess a lot of labor relative to the other factors[2]), constitute the basis for the difference in comparative cost

among countries and therefore determine the pattern of trade.

Accordingly, this accepted theory predicts the pattern of commodity trade flows that: A country will tend to specialize in the production and export of commodities whose production require relatively large amount (i.e., to other factors of production) of the factor(s) which the country is relatively well endowed (again, to other factors), and, to import commodities for which a great deal of the country's relatively scarce factor(s) is(are) employed in production.

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[1] Under the Heckscher-Ohlin Model, capital K and Labor L are the two factors in the production function, if: $K_a/L_a > K_b/L_b$, country A is referred to as relatively capital abundant.

[2] Similar to footnote 1 above, if $L_b/K_b > L_a/K_a$, country B is relatively labor abundant.

2.2 Considerations on the Assumptions of the Accepted Trade Theory

Trade theories are abstracts from existing phenomena in order to provide an adequate and generalized interpretation to certain experiences and facts. It is noted that economic thoughts should lag behind experiences in economic history. As Nurkse[3] said, "Economists are human, our mental activity is, and should be, shaped in measure by limits set by experiences." Indeed, when conditions changed, the concept derived from earlier experiences becomes inadequate in interpreting the phenomenon. Clearly, people should always be ready to adapt and to develop new hypotheses, in the hope that their works are more relevant to the changing world.

Accordingly, trade theories have continuously been modified. The accepted trade theory has also been re-examined from different angles. Basically, new proposals are developed to cope with the assumptions which are too simplified and unrealistic. To compare with the alternative trade hypotheses that follow, we would like to consider some

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[3] R. Nurkse, "Pattern of Trade and Development", in John D. Theberge ed., Economics of Trade and Development. New York: John Wiley & Sons Co., 1968, p. 85.

of the relevant assumptions[4] of the Accepted Theory. Namely, they include: the identical production functions in all countries; technology is a free good which can be employed in production activities in all countries; the absence of factor-intensity reversals; and the proportion of factor endowment is constant within a country.

Concerning the assumption of identical production functions in all countries, it is observable that this is not independent of the level of technological advancement. Even within the same country, when there is a newly developed product or a production process, other producers are incapable to produce such a product or employ such a process in production. This leads to different technological possibilities, and therefore the production function of a given industry is generally different among countries. According to the findings of Kindleberger[5], numerous production activities are indeed conducted by entirely different methods in different countries. For instance, rice-growing in the U.S. is highly mechanized, while in Burma, Java and other developing lands, these activities are still carried out

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[4] Because other assumptions, such as similar consumer preferences, linearly homogeneous production functions for all commodities, no joint products in production or consumption, etc., are not directly relevant to our study, they will not be discussed here.

[5] C.P. Kindleberger, Foreign Trade and the National Economy, Yale University Press, 1962, p. 77.

by human labor, or assisted occasionally by draft animals. The difference is much more than just a matter of factor proportion.

About the assumption that technology is a free good, it is noted that the introduction of modern technologies, the conducting of domestic Research and Development (R & D), as well as accomodating the learning processes etc., do require the expenditure of much money, time and effort. In addition, the timing for different countries to successfully employ scientific discoveries or innovations in the actual production of new products are different. These lead to the more realistic consideration that technology is not a free good. Differences do indeed exist in the technology of a given industry among countries.

Considering the assumption of non-reversibility of factor-intensities, it is found that in the production of a certain newly developed product, a great deal of technological inputs (mainly the R & D efforts provided by scientists, engineers, entrepreneurs and skillful workers) are required, making the method of production to be tha skill-intensive. After some time, as the design of this product becomes more stable, more and more machines and equipments are employed in the production of this product instead of the intensive use of technology. Hence, the method of production becomes capital-intensive. Afterwards, when the product is standardized and ready for mass production and

export, labor becomes more important. In short, the above facts serve to suggest that the reversibility of factor-intensities should not be excluded[6].

Finally, concerning the assumption that factor proportion is constant within a country[7], it is readily observed that capital accumulation and population growth do take place. But their rates are different from country to country. On the other hand, owing to the active role played by foreign investments nowadays, international mobility of capital, managerial personnels, engineers and skillful workers are rather common. As a whole, these suggest that factor endowments of countries are less pre-determined. Their proportions are subjected to change over time.

It is quite clear that once the assumptions are replaced by more realistic considerations, trade can also take place which does not conform precisely to the predictions of the accepted theory. Accordingly, various alternative hypotheses have been put forth to modify the accepted theory in explaining the causes and patterns of trade flows.

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[6] However, for a detailed theoretical and empirical demonstration of Factor-Intensity Reversals, please see B.S. Minhas' "The Homohypallagic Production Function, Factor-Intensity Reversals and the Heckscher-Ohlin Theorem", Journal of Political Economy, Vol. 70, 1962, pp. 138-156. We only attempt to describe the matter in relation to our context in particular, as product cycle trade is suggested as an explanation to factor reversals.

[7] That is, the capital-labor ratio, K/L, is constant within a country. However, this ratio is different from country to country.

2.3 Some Alternative Theories

S.B. Linder[8] has proposed an explanation of the composition of trade. He argued that the range of exportable products is determined by domestic demand. Trade is, therefore, an extension of domestic production. Income, more than other variables, appears to determine the consumption and purchasing habits of the population. Consequently, countries having similar income levels are likely to trade more intensively with each other than those countries having different income levels. This suggestion is different from the prediction of the accepted theory that trade between capital-rich and capital-poor countries tends to be more promising than that between countries whose income levels are similar. According to this emphasis on the demand side conditions, a wider scope in describing the cause of trade flows is provided.

Secondly, there is I. Kravis's "Availability" approach[9]. Kravis's hypotheses suggested that the commodity composition of trade is primarily determined by "availability". By "availability", Kravis referred to both the "availability" of natural resources as well as the "availability" of technical know-how. The "availability" of natural resources refers to the argument that trade tends to be confined to commodities

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[8] S.B. Linder, An Essay on Trade and Transformation, New York: John Wiley & Sons, 1961.

[9] I. Kravis, "Availability and Other Influences on the Commodity Composition of Trade", Journal of Political Economics, 1956, pp. 143-155.

which are not available at home (i.e., goods such as minerals which are not available for physical reasons; and goods whose output can only be increased at high cost). The later concept refers to the innovations of new products and/or new processes in production where their corresponding "unavailabilities" do allow the "available" or the "innovating" country to acquire exports advantages.

Another important alternative is M.V. Posner's "Technological Gap" hypotheses[10]. According to Posner, even though there may be no difference in relative factor-endowments, trade will be caused by technological improvements. New products and/or new processes in production are developed over time. These in turn will provide the country with a comparative advantage in certain commodities and/or processes during the time lag for other countries to imitate such innovations. Trade, then, will be caused by this existence of "technological gap" between one country and the others. And, where the longer the difference between the country's "imitation leads" and other countries' "imitation lags", the bigger will be the volume of trade flows.

All these theories had provided alternative explanations to the causes of trade which are not found or not

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[10] M.V. Posner, "International Trade and Technical Theory", Oxford Economic Paper, Oct., 1961, vol. 13, pp. 323-341.

substantially covered by the accepted theory. The importance is that: these theories and some others are not mutually exclusive, but in fact are complementary to the accepted theory. Among them, the one which is closely related to the process of economic development and emphasizes the more detail investigations of the individual products or groups of products in trade flows is the newly developed Product Cycle Theory.

2.4 The Product Cycle Theory

Trade theories developed recently do take great account on issues that we have emphasized. Among them, the Product Cycle Theory (also known as the Product Life Cycle Theory) developed by R. Vernon[11], S. Hirsch[12], W. Gruber

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11 Raymond Vernon, "International Investment and International Trade in the Product Cycle", Quarterly Journal of Economics, Vol. 80, 1966, pp. 190-207;

----------, "The Location of Economic Activity", in John H. Dunning ed., The Economic Analysis and the Multinational Enterprise. London: Allen & Unwin, 1971, pp. 89-114.

12 Seev Hirsch, "The U.S. Electronic Industry in International Trade", National Institution Economic Review, Nov. 1975, pp. 92-97;

----------, Location of Industry and International Competitiveness, Oxford 1967;

----------, "Hypotheses Regarding Trade between Developing and Industrialized Countries", in The International Division of Labor, Problem and Perspectives, International Symposium edited by Herbert Briersch Institute fur Weltwirtshaft Kiel Tubinge, 1974, pp.65-82.

and D. Mehta[13], and L.T. Wells Jr.[14] etc., since 1966 contributes to the explanation of recent world trade phenomenon. And, this theory provides a distinct ambit of interest that calls for further theoretical and empirical investigations.

The development of the product cycle model also owes contributions from authors like M.V. Posner[15], G.C. Hufbauer[16], R.W. Klein[17] and J.M. Finger[18] etc. They are credited in

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13 W. Gruber, D. Mehta and R. Vernon, "The R & D Factor in International Trade and International Investment of U.S. Industries", Journal of Political Economy, Feb. 1967, pp. 20-37.

14 Louis T. Wells Jr., The Product Cycle & International Trade, Havard University Press, 1972;

----------, "A Product Life Cycle for International Trade?", Journal of Marketing, Vol. 32, July 1968, pp. 1-6;

----------, "Test of a Product Cycle Model of International Trade: U.S. Exports of Consumer Durables", Quarterly Journal of Economics, Feb. 1969, pp. 152-162.

15 M.V. Posner, "International Trade and Technical Change", Oxford Economic Paper, Oct. 1961, Vol. 13, pp. 323-341.

16 G.C. Hufbauer, Synthetic Materials & The Theory of International Trade. London, 1965;

----------, "The Impact of National Characteristics &Technology on the Commodity Composition of Trade in Manufactured Goods", in R. Vernon ed., The Technology Factor in International Trade. Columbia University Press, 1970.

17 Roger W. Klein, "A dynamic Theory of Comparative Advantage", American Economic Review, Vol. 63, 1973, pp. 173-184.

18 J.M. Finger, "A New View of the Product Cycle Theory", Weltwirtschaftliches Archiv., 1975, pp. 79-99.

their investigations and elaborations of relevant hypotheses corresponding to such a model although their hypotheses may be labelled in the names of "Technological Gap Theory", "Dynamic Theory of Comparative Advantage" etc. We will soon realize that they are in fact consistent with the Product Cycle Model[19]. They have provided important supports for the applicability of the Product Cycle Model in explaining the trade flows of manufacturers.

In so far as the process of economic development implies continuous technology progress, new products — which are initially inventions of scientists and engineers — will be developed from time to time. It is, however, the entrepreneurs who actually bring about the realization of various innovations into new products to accomodate consumption demands. In most cases, the very incentive to introduce new products is to achieve a quasi-monopoly for a period of time.

Many such products are observed to pass through a life cycle. Starting from their initial stage as new products, they are gradually developed into more mature products. Again after some time, they become standar ized. These phenomenon form the base of the Product Cycle Model in providing expla-

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[19] Louis T. Wells Jr., "International Trade - the Product Cycle Approach", in his The Product Life Cycle & International Trade, Havard University Press, 1972, p.5.

nations for the changing patterns of comparative advantage and the world trade patterns.

We wish to define first what Product Cycle Goods are. The purpose of so doing is to facilitate the analyses that follow throughout the study. According to S. Hirsch[20], traded commodities can be classified into three categories. They are the Ricardo Goods, the Heckscher-Ohlin Goods and the Product Cycle Goods.

Ricardo Goods are those agricultural goods, mineral goods, and their corresponding products. In other words, goods that contain high proportions of particular natural resources - agriculture in certain types of land, mining and primary processing in certain areas endowed with minerals. Examples of Ricardo Goods are: Canadian wheat, Australian wool, Kuwait's oil, Chile's copper as well as Taiwan's sugar etc.

Heckscher-Ohlin Goods are referred mainly to manufactured goods, but not all of them. The comparative advantage of these traded goods is determined by factor endowment and factor proportions. Examples are: textile products, metal products, building materials and semi-conductors etc. Their main features are the stability of their production

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20 Seev Hirsch, "Hypotheses regarding Trade between Developing and Industrial Countries", in H. Giersch, Tubingen and Mohr ed., The International Division of Labor, Problem and Perspectives, Herbert Briersch Institute fur Weltwirtshaft Kiel, 1974, pp. 65-82.

process and standardization in qualities. Following the Heckscher-Ohlin theory of trade, the capital abundant industrial countries will tend to produce and to export capital-intensive commodities, and import labor-intensive commodities from the labor abundant developing countries.

The above two groups are yet unable to include all traded commodities. Those new products that are developed through innovations as well as Research and Development (R & D) efforts cannot be included. Hirsch henceforth grouped them into a category named Product Cycle Goods. Actually, Product Cycle Goods are part of the Heckscher-Ohlin Goods. When products are mature or standardized, their characteristics in production and trade can adequately be described by the Accepted Theory. On the Other hand, the Product Cycle Model offers explanations to trade flows of newly developed products before they are standardized.

Employing the United Nation's Standard International Trade Classification (SITC) system, and in the light of the above exposition, Product Cycle Goods are confined mainly to products within the SITC 5-8 categories (i.e., manufactures). This will also define our area of empirical investigations in the coming chapters.

2.5 The Essence of the Model

A figure designed by Louis T. Wells Jr.[21] is considered to be helpful in providing an overview of the Product Cycle Theory. The Three Phases of a product's life (postulated by R. Vernon[22]) are illustrated in five stages of trade flows positions between U.S., the industrial countries (mainly the Western Europe and Japan) and the developing countries.

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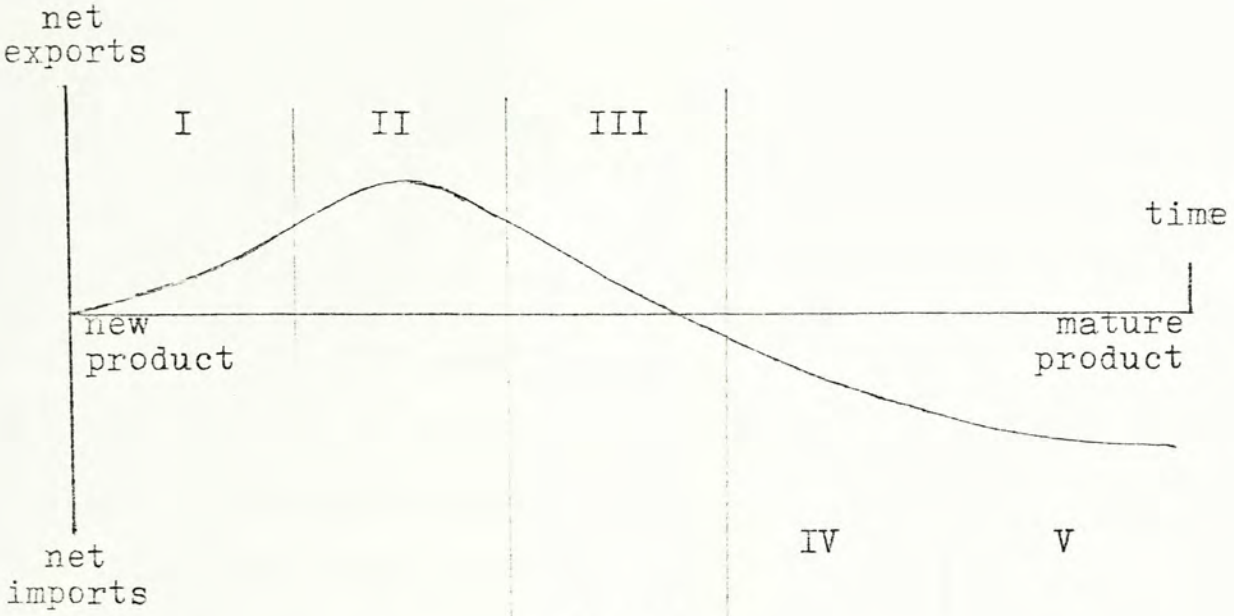
[21] Louis T. Wells Jr., The Product Cycle & International Trade, Havard University Press, 1972, p. 15.

[22] R. Vernon, "International Investment and International Trade in the Product Cycle", Quarterly Journal of Economics, Vol. 80, 1966, pp. 190-207.

Figure 1

A schematic presentation of trade flows positions in the Product Cycle Model



Stages				
I	II	III	IV	V
all productions in U.S.	productions started in industrial countries	industrial countries exports to developing countries	industrial countries exports to U.S.	developing countries export to U.S.
U.S. exports to many countries	U.S. exports mostly to developing countries	U.S. exports to developing countries displaced		

Our expositions of the entire model will be undertaken by tracing the three phases in a product's life[23], and accompanied by considerations on five issues in each of the phase respectively. Special emphasis, however, will be placed on the pattern of trade flows (product life trade) that arises.

(A) Phase One: New Products

(1) Method of Production

The production of new products required a high proportion of scientific and technological inputs. Professional knowledge as well as practical experience are hence most critical for the successful development of new products.

The employment costs of scientists and engineers therefore account for the major portion of total outlays in this introductory stage of a product. We can describe such type of production to be skill-intensive[24].

On this aspect, R.W. Klein[25] has postulated a "knowledge function" in explaining the production process,

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[23] This method of analysis was first employed by R. Vernon, and has usually beem followed by other authors.

[24] Seev Hirsch, "The U.S. Electronic Industry in International Trade", National Institution Economic Review, Nov. 1965, pp. 92-97.

[25] R.W. Klein, "A dynamic Theory of Comparative Advantage", American Economic Review, Vol. 63, 1973, pp. 183-184.

which assumes:

All firms are perfectly competitive and that a domestic firm "d"'s production function for a certain product is:

$$Q_d = S_d (Z) \times G_d (K, L) \qquad (1)$$

where S_d is the domestic firm's knowledge function of "learning factors" which depends on a vector of cumulative R & D variables, i.e.,

$$Z = (z_1, z_2, \ldots\ldots z_n) \qquad (2)$$

and, G_d is the domestic firm's "static factors" of capital and labor.

In the phase of new products production, firm "d" 's "learning factors" are assumed to outweigh the "learning factors" of other foreign firms "f", i.e.,

$$S_c (\overline{Z}) > S_f (\overline{Z}) > 0 \qquad (3)$$

making $Q_d > Q_f \qquad (4)$

but, since the marginal products of the "learning factors" are diminishing, we have

$$\text{maximum } (S_d) = \lim_{n \to \infty} (S_d) = 1 \qquad (5)$$

Hence, over time, when technology becomes stable, the marginal product of cumulative R & D factors will approach zero, and a "stable technology" is reached. In this way, foreign firms that are assumed to have comparative advantage in the employment of K and L factors, become more competitive than the domestic firm, i.e.,

$$G_f (K, L) > G_d (K, L) \qquad (6)$$

and, from (5), $S_d = S_f = 1$

therefore, $$Q_f > Q_d \qquad (7)$$

Precisely, when learning factors dominate the static factors, the domestic firm gets comparative advantage in technology and so products are being produced and exported by firm "d". But when the static factors dominate, firm "d" 's existing comparative advantage deteriorates and hence foreign productions and exports are realized. Actually, static factors are those found in the traditional production functions whilst the learning factors have not been considered. This is why the traditional model is referred as "static" in the explanation of comparative advantage.

(2) Industrial Structure

In order to minimize the costs involved in coping with the problems caused by the inherent instability of the production task, manufactures are trying to keep their investments in fixed assets and fixed overheads as small as possible. They refrain from installing "special-purpose" machineries. Rather, they tend to rely on sub-contractors and independent specialist firm to perform a large number of manufacturing operations and services.

(3) Market Demand and Price Elasticity

Because the ability of scientists and engineers to cope with the problems that will be encountered during this phase of production is the most important determinant of success, entry into the market is limited by technological know-how rather than by other considerations. Patent right and/or the possession of specialized skills protect the pioneer against encroachments from newcomers. Capital requirements are comparatively modest according to the production function discussed above.

In addition, it is a seller's market because substitutes for the product concerned is scarce and quality information to consumers is rather limited. Price elasticity is low, i.e., high price may be charged. Nylon, polythylene, transistors, radios, television sets, automobiles and the experiences presented by numerous other

new products are good illustrations of this feature. As a matter of fact, prices of most products are indeed the highest during their early days of introduction.

(4) Location of Production

According to the findings of R.W. Klein[26], U.S. gets the highest R & D inputs in industry. 74% of U.S.'s total scientists and engineers are connected with industry. Moreover, these talents are also most evenly distributed between production: 37%, R & D: 35%, management and administration: 8%。Comparable data for other countries have been found to be not so evenly distributed. This suggests that U.S.'s industrial sector has provided more favorable environment for the R & D factors to explicate their efforts.

On the other hand, U.S. also possesses a remarkable domestic market for new products. It is large, prosperous and consumers are generally of high-income level with eagerness to accept new products.

All these serve to reveal that U.S. is the best location of production of new products.

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[26] R.W. Klein, "A Dynamic Theory of Comparative Advantage", American Economic Review, Vol. 63, 1973, pp. 175-177.

(5) Trade Patterns

During these days, U.S. is the sole manufacturer as well as the sole supplier in the world market. Tje world exports of such new products is dominated by U.S.

Since the industrial countries have a more similar background in income level and consumption demand, the new products will first be exported to these countries. This makes the inter-industry trade, i.e., net trade, between U.S. and the industrial countries to be significant. On the other hand, because the developing countries have a more different income pattern (i.e., per capita income is much lower than that of U.S. or the industrial countries) and consumption demand (not so ready to accept labor-saving new products), exports of these products from U.S. to the developing countries will only be started later on in a smaller volume than those exported to the industrial countries. Accordingly, inter-industry trade between U.S. and the developing countries is rather small.

(B) Phase Two: Mature Products

(1) Method of Production

New products that have survived after the introductory phase then enter t eir mature phase. At this stage, as the demand for these products expands, according to Vernon[27],

[27] R. Vernon, "International Investment and International Trade in the Product Cycle", Quarterly Journal of Economics, Vol. 80, 1966, p. 195.

"a certain degree of standardization will take place". And,"though the sub-categories may multiply, and the efforts in product differentiation increase (due to more and more vigorous competitions), anyway, a growing acceptance of certain general standards seems to be typical." Hence, mass production and mass distribution take place. Special purpose machinery are utilized in order to reduce the cost of production. Assembly-lines, continuous processes, as well as other mass production techniques will also be employed wherever appropriate. The ratio of skilled personnel to capital is consequently reduced, and the process of production becomes more and more capital-intensive.

In R.W. Klein's terminology, the "learning factors" are gradually losing their comparative advantage in production. And, that the "static factors", i.e., K and L, especially K in this phase, become more and more important.

(2) Industrial Structure

More and more firms are now attracted to such an industry in order to get benefits from a growing market. The expiry of patents, the development of close substitutes, and the acquisition of manufacturing skills, make entry technically possible. Suppliers of capital are more eager in backing up enterprises which possess capabilities in expanding markets. This also makes entry to be possible

even in productions requiring heavy capital investments.

During these days, talents of administration, of cost management, and of marketing methods are critically important instead of the scientists and engineers. Management, defined in the broadest sense, becomes the most important human-input during this phase.

(3) Market Demand Structure and Price Elasticity

Market demands of these mature products are becoming more and more price elastic. Customers have a larger number of suppliers to choose from. In order to attract customers and to maintain their acquired markets, manufacturers have to offer additional services, such as: repair facilities, guarantees, and fast delivery etc.

(4) Location of Production

Following the discussion in (B) (1), those capital abundant industrial countries are becoming more and more advantageous in the production of the mature products. They are capable to install those specialized machinery and equipment as required. Thus, import-substitution productions start and exports begin. On the other hand, when the foreign demands for such products have grown to a certain extent, and when the cost of production in the industrial countries plus the cost of transportation are lower than the costs of the U.S.

Products, the U.S. firms are likely to make investments abroad in order to maintain competitiveness. Hence, the locations of production in mature products will be shifted to the industrial countries.

(5) Trade Pattern

During this phase, the mature products are produced in the industrial countries, initially for import-substitutions, and then, the scale of production expands and exports starts. Products will be exported to the developing countries to compete with the U.S. products. Gradually, the U.S. exports in such products to the developing countries will be displaced. When costs of production plus cost of transportation happen to be even cheaper than the domestic prices of the U.S. products, these products turn out to be competitive in the U.S. market as well. Accordingly, inter-industry trade is found to contract between U.S. and the industrial countries. But, at the same time, the intra-industry trade, i.e., total trade, becomes growingly significant between U.S. and the industrial countries.

On the other hand, as inter-industry trade between U.S. and the developing countries gets smaller, the inter-industry trade between the industrial countries and the developing countries will be increasingly significant. This is because exports of such mature products from the U.S. to the developing countries are displaced by those of the industrial countries.

(C) Phase Three: Standardized Products

(1) Method of Production

As the market gets saturated, the mature products enter their standardized phase. Products specification are by now quite standardized, i.e., the sequence of operations as well as their scales are more or less fixed, and innovations in either the products or the production processes are getting rarer.

The size of manufacturing units become larger, economies of scale is an important factor in determining the competitive strength of individual manufacturers. Other than heavy capital investments, the production process becomes more labor-intensive. The composition of the labor force also alters, i.e., the proportion of unskilled and semi-skilled workers rises in comparison with the previous phase and therefore wage outlays account for a growing percentage in the total cost of production

(2) Industrial Structure

Since competition is now more and more vigorous, market position and financial resources affect entry. Number of firms is found to be decreasing due to the failure under competition. The supply of cheap labor becomes more vital. Ordinary working labor becomes the most important human-input in this phase.

(3) Market Demand Structure and Price Elasticity

Market demand is now not only price elastic, but actually, price-sensitive. Prices have to be adjusted to the level of the least cost seller. Customers' expectations regarding the products, their specifications and useful life expectancy etc., become stable. Since customers are now well informed about alternative sources of supply and they are sufficiently experienced to identify among the qualities of various products.

In this phase, servicing is more than a matter of routine check-up, minor adjustments and replacement of faulty parts. It becomes an essential function in marketing which determines whether a certain product will be purchased by buyers or not.

(4) Location of Production

The developing countries are relatively labor-abundant. Plentiful supply of cheap labor are found in these lands. Henceforth, in this phase, the developing countries may offer competitive advantages as a production location for the now labor-intensive standardized products.

The development process is similar to that experienced by those industrial countries in the second phase. The developing countries will first start in their import-substitution productions. To supply their domestic demands of such products which were originally imported mainly from

U.S. and later on from the industrial countries. As the volume of production grows over time and the domestic markets are saturated, exports of these exports will be ready for competition with those produced by the industrial countries in the world market. And in case that costs of production plus costs of transportation in these developing countries become cheaper than the corresponding prices in the industrial countries' home markets, keen competition will take place in the industrial countries. Gradually, the industrial countries become importers of such products.

(5) Trade Pattern

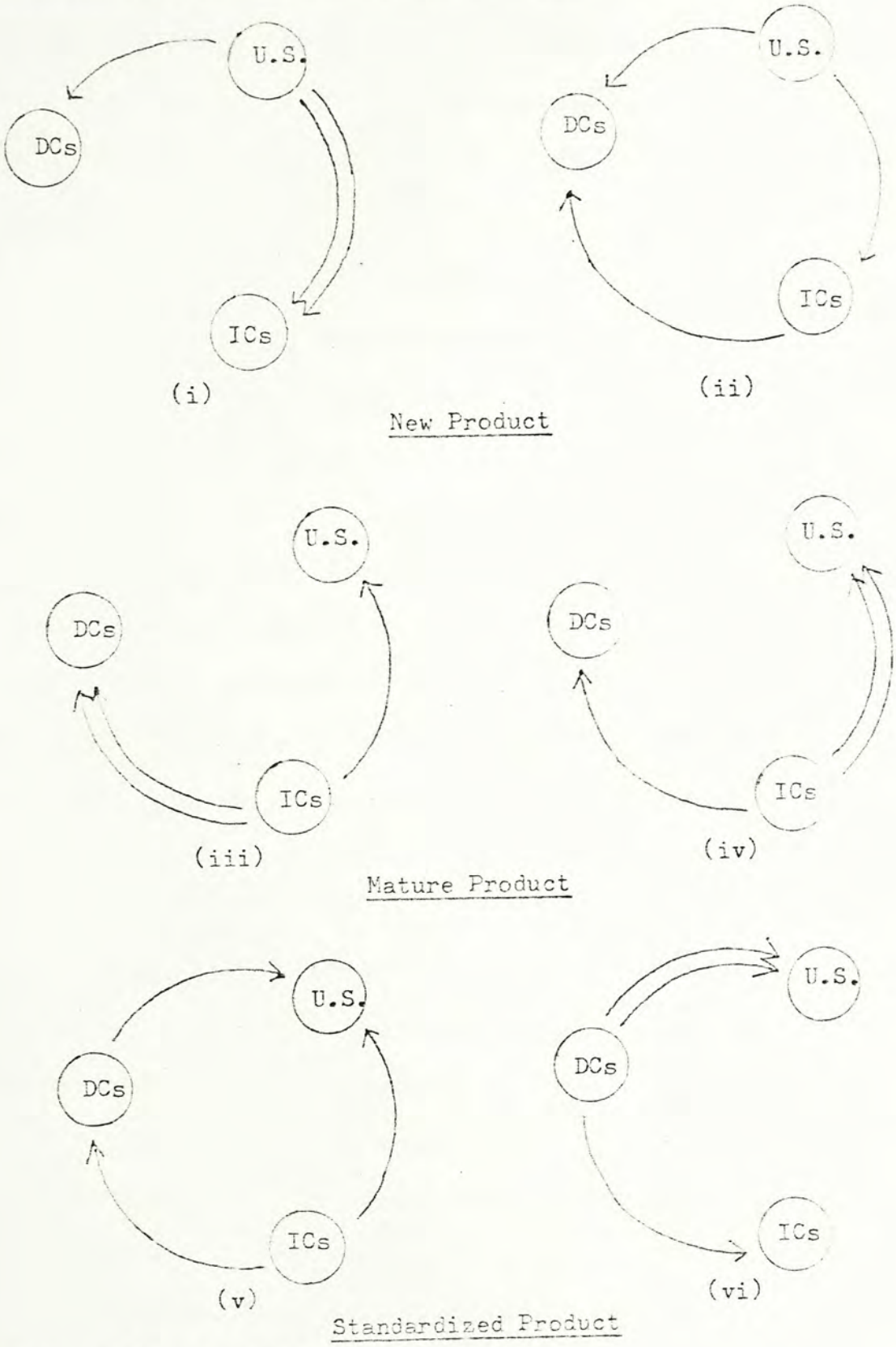
In these days, inter-industry trade between the developing countries and the industrial countries deteriorates; while intra-industry trade becomes more and more significant. This is due to the initial import-substitution activities as well as the export-expansion that follows in developing countries. Finally, after a period of time, inter-industry trade between these countries will increase again. But, net importers are the industrial countries. On the other hand, intra-industry trade on such products may found to be more significant or deteriorated depending on whether such products contain a wide range of versions or not. If they do contain many versions, intra-industry trade may become more significant; whilst in the case of few versions, intra-industry trade may deteriorate.

Also notably, in these days, U.S. imports of these standardized products from the developing countries will increase due to their cheaper prices than those produced by the industrial countries. Hence, inter-industry trade is once again found to be increasing between U.S. and the developing countries. However, the flows are now in the opposite direction, i.e., U.S. is now the importer or even a net importer. This completes the life cycle of a newly developed product.

After all, we found out that the Product Cycle Model is again based on the difference in factor endowments among countries. And, in the different phases of the life of a product, different factors which produce comparative advantage in production at a certain phase will dominate the production functions. That is: in the phase as a new product, skill-labor is the dominating factor in production. Henceforth, the technology abundant U.S. gets comparative advantage in the production and exports of new products. Then, as a mature product, capital becomes the most important input in production. So, the industrial countries have comparative advantage in the production and exports of mature products. Finally, being a standardized product, working-labor is the critical factor in production. Therefore, the developing countries are likely to acquire the comparative advantage in the production and exports of

Figure 2

Trade Flows Pattern in the Light of the Product Cycle Model



Note : U.S. - The United States
ICs - Industrial Countries
Dcs - Developing Countries
===== Larger volume of trade flows of a certain product
----- Smaller volume of trade flows of a certain product

a standardized product. This model suggests that production functions of certain product are different in various phases of its life cycle. This analysis is consistent with the fact that various countries are at various stages of economic development and therefore have comparative advantage in various manufactured products.

As a whole, the product cycle model illustrates the existence of a certain proportion of trade flows, i.e., the product cycle trade. And, such an illustration is of particular importance to the developing countries. In the light of this model, the developing countries will be in a better position to identify their directions of productions and exports. Due to the fact that manufactured products will generally go through life cycles after they have been innovated, those technology abundant and/or capital abundant industrial countries will not always possess comparative advantage in the production and export of these products. If the product's competitiveness (when it becomes matured or standardized) rests eventually on cheap labor costs or light capital investments, the developing countries will be in an advantageous position for its production and exports. We shall illustrate this in our study of bilateral commodity trade between Japan and Taiwan.

In concluding this chapter, the author would like to present a figure in revealing the Product Cycle Model's hypotheses on trade flows concerning manufactured goods.

Figure 2 illustrates that,

in phase (i), U.S. is both the sole producer and supplier of a certain new product, say A, in the market. The industrial countries (ICs), being similar in income level and consumption taste to that of the U.S., will have an earlier timing of the imports of A as well as at a greater volume of imports than those developing countries (DCs) whose income level and consumption taste are rather different from that of the U.S.;

in phase (ii) Productions of A gradually take place in the ICs. And, their products will be competitive in both the domestic markets of the ICs as well as the markets of the DCs. Hence, a portion of U.S.'s exports (of A) is replaced;

in phase (iii) The ICs become the main producer and supplier of product A. Other than produces some for her domestic consumption, U.S. will import some from the ICs. On the other hand, the demands of A in the DCs will chiefly be supplied by the ICs;

in phase (iv) As the production of A take place in the DCs, its supply dependence from the ICs is alleviated. On the other hand, the U.S. will probably refrain from the production of A. So, her demands of A will depend on imports;

in phase (v) Other than their domestic markets, productions of A by the DCs will gradually become competitive in the U.S. market;

in phase (vi) Eventually, the DCs become the main producer and supplier of product A. The ICs will also refrain from the production of A gradually.

CHAPTER III

THE ECONOMIC BACKGROUND OF THE BILATERAL TRADE PARTNERS: TAIWAN AND JAPAN

In the original context of the Product Cycle Model, the U.S. is postulated to be the creator of product cycles[1]. Other countries, no matter what is her level of industrialization, are considered to be on the process of catching-up of product cycles. Actually, many new products are not innovated and developed by the U.S. Rather, they are developed by other countries, and they will also go through their respective life cycles. And, their location of production will also shift from the innovating countries to other countries as they become mature or standardized. Thus, product cycle trade will also occur in these products. In addition, the original product cycle model has not taken into account the quality and characteristic of a new product as well as its likelihood to become a product cycle good in the world market. In viewing all these considerations, we would like to give arguments for the suggestion that, besides the U.S.,

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[1] The terms "Creator of Product Cycles" and "Catching-up of Product Cycles" were suggested by K. Akamatsu in his "A Historical Pattern of Economic Growth in Developing Countries" in The Developing Economics. Tokyo: The Institute of Asian Economic Affairs, 1962, p.11. They are employed here only because the author consider that they can describe the situations of Japan and Taiwan suitably.

there are other creators of product cycles. And, more important, if new products developed by a creator of product cycles are more commonly accepted in the world market, then, various domestic productions and so as product cycle trade will more likely to take place than those new products which are less commonly accepted.

In the present study, the situations of Japan and Taiwan will be discussed as an example. This serves to provide strictly the theoretical backgrounds for incorporating the product cycle approach into a bilateral trade flows analysis.

3.1 Japan's Position - A creator of Product Cycles

Japan is the first Asian country to have undertaken the process of industrialization. Owing to her lack of domestic resources (such as: petroleum, iron ore, coal and non-ferrous ores etc.) and with a limited arable land relative to its population, Japan's development process had to rely much on foreign trade. In order to acquire food-stuffs and raw materials to support her economic progress, Japan had to provide various manufactures for the exchange. That is why Japan's pattern of trade is so closely related with her industrial structure in her development process.

Japan has undergone three distinct structural changes[2]

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[2] The suggestion of the "three structural changes" of Japan during her process of economic development was given by K. Kojima in his Japan & a Pacific Free Trade Area. London: Macmillan, 1971, pp. 9-12.

during her industrialization process. The first was the " Light Industrialization " that began early this century and accelerated after World War I. During those days, Japan's foreign trade was of the processing type, i.e., by importing raw materials, manufacturing them for domestic use and exports. Textiles, foodstuffs as well as other light industrial products were the major exportables.

The Japanese continued to learn, to purchase and to absorb scientific know-how and technology from the advanced countries. At the same time, Japan increased persistently her investments on R & D. These efforts consequently led to Japan's second structural change in the late thirties, namely, the " Heavy and Chemical Industrialization ". But, this process could only be accomplished in the mid-sixties. However, during the fifties, plans have been formulated to madernize and rationalize the steel industry, to create a petro-chemical industry, to promote the heavy machinery and automobile industries, to expand the electronic and synthetic rubber industries and to revive the ship-building and aircraft industries. Then, during the sixties, the industrial structure of Japan was shifted rapidly towards heavy and chemical industries.

In this way, Japan has managed to develop her capital-intensive industries. Her exportables are now mainly manufactures such as iron and steel products, chemical products, transportation equipments and various machineries. Nowadays, exports from this initially labor abundant country, were, on the average, more capital-intensive than her imported

products[3]. Indeed, Japan has grown up to be one of the typical industrial countries.

These changes in Japan's industrial structure and pattern of trade are basically consistent with Japan's comparative advantage positions. In the early days, Japan got the advantage of an abundant supply of cheap labor; later, Japan's capital and efficient labors still had comparative advantage when compared with other advanced countries. Nowadays, due to the rapid increase in her wage costs, Japan has lost or is losing her comparative advantage in many products to those developing countries with abundant supply of cheap labor. Such products are mainly those primary goods, light manufactures as well as those standardized products.

Seeing that her competitiveness in these products have deteriorated, Japanese producers, in addition to the developing of the more sophisticated versions of these products, tried to follow the route of the U.S. to innovate and develop their own skill-intensive products. The recent records of Japan's export trade does indicate such a trend.

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3 Such a remark is based on the findings of M.I. Tatemoto in his " Factor Proportions & Foreign Trade - the case of Japan ", Review of Economics & Statistics, Nov., 1959.

Table 3.1

Composition of Japan's Exports by Type of Industry

Unit : %

Type of Industry	Year 1955	1960	1965	1970
Labor-intensive	58.9	55.1	36.5	27.7
Resources-consuming	22.3	14.9	21.3	18.9
Skill-intensive	18.6	29.6	41.6	52.7
Total	99.8	99.6	99.4	99.3

Source : Japan Economic Research Centre (JERC), Japan's Economy in the 1980 in the Global Context, Tokyo, 1972, p.31.

Note : [4] Labor-intensive industries : foodstuffs, textiles, other light industrial products;
Resource-consuming industries : raw materials and fuel, non-metal ores, iron and steel, non-ferrous metals;
Skill-intensive industries : chemical products, general purpose machineries, electronic machineries, transport equipments and precision machinery.

[4] These notes are provided in along with the table concerned in the source.

From the above table, it is observed that Japan's export trade has shifted towards " Skill-intensive Industrialization ". Hence, another structural change after the " Heavy and Chemical Industrialization " has taken place. According to the findings of Louis T. Wells Jr.[5], during the last fifteen years, the Japanese manufacturing industries have vigorously absorbed and purchased technologies from U.S. and other advanced countries. And accompanied by her own R & D efforts, Japan has eventually come to possess such a level of scientific and technological knowledge that began to innovate and to develop new products herself.

More important is, Japan is found to be the country that is most likely to innovate or design new products that satisfy needs of middle or low income consumers[6]. Her new products, on the average, are found to be not so labor-saving but more practical. Accordingly, such products are bound to be more commonly accepted by the developing countries. And, because of the closeness in geographic positions, Japan has become an immediate supplier of many such products to those developing countries in Southeast Asia in particular.

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5 Louis T Wells Jr., " Test of a Product Cycle Model of International Trade : U.S. Exports of Consumer Durables ", Quarterly Journal of Economics, Feb. 1969, pp. 160-162.

6 Louis T. Wells Jr., " International Trade - The Product Cycle Approach ", in his ed., The Product Life Cycle and International Trade. Harvard University Press, 1972, p.5.

Under such circumstances, it is considered to be mutually beneficial for Japan to foster an industrial re-adjustment aiming at the continuous contraction of those industries which the deveoping countries have or are gaining comparative advantage on one hand, and, the promotion of the growth of her new, comparatively advantageous sectors on the other. Those skill-intensive products such as computers, aircraft, electric cars and other transport system, complex assembly industries such as communication equipments, office machinery, construction machinery, will become important and competitive sectors of the Japanese export trade. This re-adjustment will, at the same time, provide more opportunities for the increase in imports of those labor-intensive products from the developing countries. In short, the Japanese economy's moving towards skill-intensive industrialization has indicated a basic switch of her pattern of trade from that characterized by the catching-up of product cycles to that of the creation of product cycles. And, this serves to clarify part of the background in conducting our analyses.

3.2 Taiwan's Situation - Catching-up of Product Cycles

Being small in area and poorly endowed with natural resources, foreign markets are again vitally needed in accommodating Taiwan's production expansions as well as development

activities. Although started her industrialization process only late in the mid-fifties, Taiwan's achievements are remarkable. Similar to that of Japan, Taiwan's industrial structure, and so as the inter-related pattern of trade, have gone through various adjustments during her process of economic development to suit the circumstances.

At the beginning, a comprehensive land reform program was executed. This consisted of the purchasing and redistribution of the arable land, the improvement of seeds, the increasing of yields per unit of land, the shortening of the growing periods of plants, the introduction of inter-crop planting, the improving and constructing of irrigation systems, as well as the applying of chemical fertilizers in cultivation. As a result, the agricultural sector of Taiwan did play its part in providing the " effective surplus " (agricultural savings) to support the development of light industries[7]. From 1953 onwards, five Four-Year Economic Development Plans[8] have been implemented in Taiwan. Through the

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7 Mo-huan Hsing, " The Development Experience of Taiwan and South Korea : A Comparison ", Hong Kong : Economic Research Centre, CUHK, pp. 5-9, 1974 .

8 They were : The 1st Plan, 1953-1956,
the 2nd Plan, 1957-1960,
the 3rd Plan, 1961-1964,
the 4th Plan, 1965-1968,
the 5th Plan, 1969-1972.

development stages of import-substitution, export-expansion, and accompanied by the continuous constructions in social and industrial infrastructures as well as the rapid accumulation of capital, Taiwan's industrial structure and the related pattern of trade were changed accordingly. In the interest of the present study, we shall inspect in particular Taiwan's changes in the composition of her trading commodities in respect to the periods of the five development plans.

Table 3.2

Taiwan's Major Exportables

Rank	1956 Item	%	1960 Item	%	1964 Item	%	1968 Item	%	1972 Item	%
1	sugar	52.2	sugar	44.0	sugar	29.6	textiles	22.5	textiles	27.3
2	rice	14.1	textiles	13.9	textiles	13.8	electrical apparatus	9.8	electrical apparatus	16.4
3	canned food	5.0	canned food	4.8	banana	6.8	canned food	9.7	plastic product	5.9
4	litro-nella	4.5	banana	3.7	canned food	6.7	plywood	6.7	plywood	4.6
5	tea	4.2	tea	3.7	plywood	6.0	banana	5.9	canned food	4.0
6	textiles	2.9	basic metal	3.2	rice	4.6	sugar	5.7	basic metal	3.3
7	banana	2.3	rice	3.1	basic metal	3.2	plastic product	4.2	timber product	3.3
8	basic metal	2.3	chemicals	3.0	cement	3.0	chemicals	2.8	machinery	3.2
9	chemicals	1.6	litro-nella	2.1	timber product	2.7	machinery	2.8	sugar	2.8
10	salt	1.2	timber product	1.9	chemicals	2.2	timber product	2.4	transport equipment	2.1
	Total	90.1		83.2		78.6		72.6		72.7

Source : Quartery Journal of Bank of Taiwan, 4/Vol.27, pp.4-8

From Table 3.2, it is observed that in the first period, exportables of Taiwan were only those primary goods such as suger, rice, litronella and some primary products like canned food. Then, textile products, the typical labor-intensive good , became Taiwan's leading export commodities. At the same time, some other light industrial products such as plywood, timber products and basic metals were noted to be increasingly important in Taiwan's export trade.

In the latter periods, those more capital-intensive goods such as plastic products, chemicals, electrical apparatus and appliances and even machineries became more and more important in Taiwan's export trade. This indicates that Taiwan has moved to a position of the productions and exportations in some capital-intensive goods. To be more clear, such a change in Taiwan's pattern of trade can be shown if her export commodities are in turn classified into three major categories (namely : primary goods, primary products, manufactured goods) and their corresponding performances were tabulated in Table 3.3.

Table 3.3

Structural Change in Taiwan's Exports (1955 - 1975)

Unit : %

Year	Primary Goods	Primary Products	Manufactured products
1955	27.6	61.8	10.6
1956	18.6	64.4	17.0
1957	15.6	71.6	12.8
1958	23.7	62.2	14.1
1959	23.6	52.8	23.6
1960	12.2	55.5	32.3
1961	14.9	44.1	41.0
1962	11.9	37.6	50.5
1963	13.5	45.5	41.0
1964	15.0	42.5	42.5
1965	23.6	30.4	46.0
1966	19.8	25.2	55.0
1967	15.2	23.2	61.6
1968	11.1	20.4	68.5
1969	9.3	16.7	74.0
1970	8.5	12.8	78.7
1971	7.9	11.2	80.9
1972	6.8	9.9	83.3
1973	7.5	7.9	84.6
1974	4.8	10.7	84.5
1975	5.6	10.8	83.6

Source : Taiwan Statistical Data Book, 1976, p.182.

It is observed that the percentage in total exports of primary goods has declined continously from the beginning of the period. In fact, during the mid-fifties, Taiwan had started her development process, and the production of primary products were encouraged instead. Consequently, the primary products were Taiwan's major exportables before 1965.

From 1965 onwards, i.e., starting from Taiwan's 4th Four-Year Economic Development Plan, manufactured products have displaced the position of primary products to become Taiwan's major exportables. By the end of the period, its percentage has gone up to 83.6. This tells that throughout the economic development process, Taiwan has managed to upgrade her industrial structure, namely, from the initial primary productions to that of light industrial productions, followed by the labor-intensive productions in those standardized products such as textile products, plastic products, electrical apparatus and appliances etc., and recently, to the production and exportation of more capital-intensive goods such as machineries, synthetic fabrics, plastic materials, chemical products, electronic components and chemical fertilizers. At the present stage, Taiwan's labor costs are still relatively low compared to many other countries. In short, Taiwan possesses comparative advantage in the production and exportation of mature and/or standardized products. Thus,

comparing with Japan's situation, Taiwan is the type of trade development that characterized by the catching-up of product cycles.

3.3 Considerations on the Bilateral Environment

After the industrial structures and patterns of trade of our bilateral trade partners have been revealed, we would like to give reasons for selecting them in an analysis of the Product Cycle Model at a bilateral trade flows level.

The geographic proximity of the two countries, their historical ties, their difference in the stages of industrialization as well as the similarities in their consumption tastes[9], all these have led to the very close relationship in trade of Taiwan and Japan. The following records indicate such a fact.

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9 With similar consumption tastes, products of the countries are more complementary. Thus, trade flows will be more significant.

Table 3.4

Trade Volume of Taiwan vs Japan

Year	Exports (in % of Taiwan's total exports to all countries)	Imports (in % of Taiwan's total imports from all countries)
1953	46.4	28.5
54	53.9	30.3
55	60.6	30.9
56	35.5	34.7
57	38.9	33.4
58	43.9	33.5
59	42.7	36.9
1960	37.4	34.4
61	28.5	32.1
62	24.2	32.7
63	33.1	28.8
64	30.9	34.8
65	30.6	39.8
66	24.0	40.0
67	17.9	40.5
68	16.2	40.0
69	15.0	44.2
1970	15.1	42.8
71	12.3	44.9
72	12.9	41.6
73	18.7	37.7
74	15.2	31.8
75	13.1	30.4
Average	29.6	37.2

Source : For 1953 to 1963 data - Table10-10, Exports by Countries of Destination, p.114; Table 10-11, Imports by Source, p.115. Taiwan Statistical Data Book, 1964, Council for International Economic Cooperation and Development, Executive Yuan, R.O.C.

For 1964 to 1975 data - Table 148, External Trade by Regions and Countries, pp.248-291. Statistical Yearbook of the Republic of China, 1976, Direcorate-General of Budget, Accounting & Statistics, Executive Yuan, R.O.C.

By Table 3.4, the importance of Japan to Taiwan's external trade has been indicated. In respect to total imports from the world, the share imported from Japan in particular has persistently maintained a very high percentage up to 37.2, Taiwan is considered to be an immediate market for the Japanese products.

On the other hand, concerning Taiwan's exports to Japan, although the relevant share is still significant on the average, its importance has decreased. From the initial position of 46.4% in 1953 to that of 13.1% in 1975, showing that Taiwan's export dependence on the Jpanese market has been alleviated by means of export diversifications.

Following the arguments in section (1), this chapter, Japan has grown up to be a typical industrial country. Other than the purchasing and absorbing of new scientific knowledges and technologies from other advanced countries, Japan has gradually become a country that possesses comparative advantage in the production and exportation of skill-intensive new products. In addition, since new products developed by Japan are generally more practical (when compared with those more luxurious versions developed by the U.S. and Western Europe, in the view of the developing countries) and less expensive. They are more welcomed by the developing countries. Henceforth, many of these new products are found to be rather

competitive in the world market, particularly in the nearby Southeast Asian countries. Moreover, since these products can be produced with less technology and capital inputs, the process of import-substitution in the developing countries can usually take place earlier. Henceforth, shorter life cycles of products and eventually earlier product cycle trade could be expected.

In addition, such a shift in the location of production is well based on the principles of Comparative Advantage. Developing countries which possess a stronger comparative advantage position in the production of mature and/or standardized products are in a better position to be benefited from the " catching-up of product cycles ". Following the discussions in section (2), this chapter, we know that Taiwan is in a better position than many other developing economies in this aspect.

As a whole, since Japan is a creator of product cycles whilst Taiwan is in a catching-up of product cycles position, and with such close economic ties, phenomenon of product cycle trade should be detectable within these two countries' bilateral commodity flow records. So, after presenting a simplified model and the corresponding approach for the present study in the following section, we will go into the empirical test.

3.4 The Suggested Model

Although many empirical studies concerning the Product Cycle Model have been conducted[10], however, their investigations were mainly on some of the industries or even a particular industry in a certain country. The present study, on the other hand, is aimed at the finding of empirical evidences to substantiate the existence of the product cyles of the manufactured goods within a bilateral trade case.

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10 The studies are :

(a) Louis T. Wells, Jr., " Test of a Product Cycle Model of International Trade : U.S. Exports of Consumer Durables ", Quarterly Journal of Economics, Feb. 1969, pp. 152-162.

(b) Seev Hirsch, " The United States Electronic Industry in International Trade ", National Institution Economic Review, Nov. 1965, pp. 92-97.

(c) Robert B.Stobaugh, " The Neo-technology Account of International Trade " : The Case of Petro-chemicals ", in L.T.Wells Jr. ed., The Product Life Cycle and International Trade, Harvard University Press, 1972, pp. 83-99.

(d) Yoshihiro Tsurumi, " R & D Factor and Exports of Manufactured Goods of Japan ", in L.T. Wells Jr. ed., The Product Cycle and International Trade, Harvard University Press, 1972, pp.161-179.

(e) Jose R. De la Torre, Jr., " Marketing Factors in Manufactured Exports from Developing Countries ", in L.T. Wells Jr. ed., The Product Life Cycle and International Trade, Harvard University Press, 1972, pp. 277-245.

(f) Gary C. Hufbauer, Synthetic Materials and the Theory of International Trade, London : Gernald Duckworth & Co., 1965.

(g) Gordon K. Douglass, " Product Variation & International Trade in Motion Pictures ", doctoral dissertation, M.I.T., 1963.

We shall test whether a developing country like Taiwan did exhibit the experience of product cycle trade in her bilateral commodity flows with Japan. This would involve inspections on whether in the early days when certain products are produced and exported by Japan, Taiwan was only a consumer and importer. Then, when these products became more mature, Taiwan would start her own productions. But as long as the volume produced was smaller than the domestic demands, Taiwan still had to import such a product. Only when the volume produced became larger than the domestic demands, exports of such a product would be realized.

In the analyses that follow, the United Nations' " Commodity Trade Statistics " and data from the " Japan Exports and Imports " will be employed in calculating various trade flow indices. These two sets of statistical data are both prepared according to the Standard International Trade Classification (SITC) system which is most commonly employed in doing empirical studies on trade.

To facilitate the works that follow, the contents of the SITC (up to the 3-digit level) are reproduced on the next two pages.

Standard International Trade Classification (SITC)

Summary Table

0 : Food
1 : Beverages and Tobacco
2 : Crude Materials, inedible, except fuels
3 : Minerak fuels, lubricants and related materials
4 : Animal and vegetables oils and fats
5 : Chemicals
6 : Manufactured goods classified chiefly by material
7 : Machinery and transport equipment
8 : Miscellaneous manufactured articles
9 : Others

Detailed Table

511 inorg chemicals
512 org chemicals
513 gaseous chem
514 inorg chem nes
515 radioact etc mat
521 tar or coal chem
531 coaltar dyes etc
532 dye tanning extr
533 paints etc
541 drugs etc
551 essential oils
552 soap cosmetics
553 perfume cosmetic
554 soap detrgnt etc
561 fertilizers mfd
571 exposives etc
581 plastic material
599 chem mat prd nes
611 leather
612 mfs leather etc
613 furs dressed etc
621 rubber semifishd
629 rubber mfd nes
631 veneer plywd etc
632 wood mfs nes
633 cork mfs
641 paper paperboard
642 paper etc mfs
651 yarn thread
652 cotton fabrics
653 miscel fabrics
654 ribbons etc
655 special fabrics
656 madeup textiles
657 rugs lino etc
661 lime cement etc
662 bricks tiles etc
663 mineral mfs nes
664 glass
665 glassware
666 pottery
667 gems etc
670 iron and steel
671 pig iron etc
672 primry steel etc
673 shapes iron stl
674 plates iron stl
675 hoop strip
676 ry rails etc
677 wire iron steel
678 pipes iron stl
679 castings irn stl
681 silver etc metal
682 copper
683 nickel
684 aluminium
685 lead
686 zinc
687 tin
688 uranium thorium

689 base metal nes
691 constr metal
692 containers metal
693 wire prod nonel
694 nails bolts etc
695 hand tools etc
696 cutlery
697 house wares metl
698 metal mfs nes
699 misc metal mfs
711 power mach nes
712 agriculture mach
714 office machry
715 metalwrking mach
716 misc machinery
717 textile etc mach
718 mach fr spec ind
719 machinery nes
721 elec mach equip
722 elec power mach
723 elec distrib mac
724 telecom equip
725 domestic elec equip
726 elec medical equip
729 elec mach nes
731 railway vehicles
732 road motor veh
733 road veh nes
734 aircraft
735 ships and boats
812 bldg fixtures
821 furniture etc
831 handbags etc
841 clothes not fur
842 fur clothes etc
851 footwear
861 instruments etc
862 photo goods
863 devd movie film
864 watches clocks
891 music instru etc
892 printed matter
893 plastic mfs nes
894 toys etc
895 stationery etc
896 art works etc
897 gold silver wares
899 mfd goods nes

Various methods of calculation[11] have been proposed in analysing trade flows. In the present study, the modified Inter- and Intra-Industry Trade Level Indices are employed. These measures were initially suggested by

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11 The alternative measures are :

(i) Verdoon's Export-Import Ratio : $U_i = \frac{X_i}{M_i}$

this ratio varies between 0 and $+\infty$, hence, the range for comparison is not well confined.

(ii) Michaely's Index of Dissimilarity :

$$D_i = \sum_1^n \left| \frac{X_i}{\sum X_i} - \frac{M_i}{\sum M_i} \right|$$

this index varies between 0 (complete similarity) and 2 (complete dissimilarity). Clearly, this index cannot reveal the position of exports or imports either.

(iii) Linneman's Cosine Measure :

$$G_i = \frac{\sum_1^n X_i M_i}{\left(\sum_1^n X_i^2 \sum_1^n M_i^2 \right)^{1/2}}$$

this measures the cosine of the angle between the vectors or exports of commodities and imports of commodities in a multi-commodity space. The ratio varies between 1 (X = M) and 0 (X = 0 or M = 0). It is a rather complicated method and again incapable to reveal the exact position of X or M.

H.G. Grubel and P.J. Lloyd[12] and have been adopted by others in doing relevant empirical studies on trade flows. The original expressions are :

(1) The Inter-Industry Trade Level Index :

$$A_i = \frac{|X_i - M_i|}{X_i + M_i} \cdot 100 \qquad (1)$$

where X_i and M_i are exports and imports of products valued in the same currency at a certain level of aggregation.

Actually, this is a measure of " Net Trade ". However, by using this method of calculation, measurements will be prepared in a more confined range and can easily be compared. Namely, this index varies between 0 if there is neither export or import specialization (i.e., $X_i = M_i$) and 100 if there is export but no import or the vice versa (i.e., $X_i = 0$ or $M_i = 0$).

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12 (i) H.G. Grubel & P.J. Lloyd, Intra-Industry Trade, London : Macmillan, 1975.

(ii) ----------, " The Empirical measurement of Intra-Industry Trade ", Economic Record, Dec. 1971, pp. 491-517.

(iii) H.G. Grubel, " Intra-Industry Specicialization & the Pattern of Trade ", Canadian Journal of Economics & Political Science, Aug. 1967, pp. 374-388.

(iv) ----------, " The Theory of Intra-Industry Trade ", in the Studies in International Economics, ed. by I.A.McDougall & R.H.Snape. North-Holland, Amsterdam, 1970, pp. 35-51.

(2) Similarly, the Inter-Industry Trade Level Index :

$$B_i = \frac{(X_i + M_i) - |X_i - M_i|}{X_i + M_i} \cdot 100 \qquad (2)$$

again, this is also a systematic way in revealing " Total Trade ", where B_i lies in the closed interval $[0, 100]$, i.e., $B_i = 100$ when $X_i = M_i$ and $B_i = 0$ when $M_i = 0$ or $X_i = 0$. And from these two expressions, it is noted that,

$$A_i + B_i = 100 \qquad (3)$$

Nevertheless, since our main interest rests on both the level and directions of commodity trade flows, these indices are not adequate enough to meet our requirement. That is to say, in case we obtain an index of $A_i = 100$, for instance, we can not identify its position of trade flow. We are not informed by this index whether the country concerned is a net exporter or a net importer, because both $M_i = 0$ or $X_i = 0$ will result in a $A_i = 100$. In order that the position of trade flow can clearly be indicated, some modifications on the formula of these indices are necessary so that their merits in measuring trade flows can be retained while their shortcomings can be eliminated.

By the removal of the absolute signs of formula (1) and (2), we have,

(1a) The Inter-Industry Trade Level Index :

$$A_i = \frac{X_i - M_i}{X_i + M_i} \cdot 100 \qquad (4)$$

now, A_i lies in the closed interval $[-100, 100]$, and the trade flow positions are clearly indicated as :

$$A_i = -100 \quad \underset{X = 0}{|} \quad X < M \quad \underset{X = M}{|} \quad X > M \quad \underset{M = 0}{|} \quad 100$$

(2a) And, from formula (2), the Intra-Industry Trade Level Index becomes,

$$B_i = \frac{(X_i + M_i) - (X_i - M_i)}{X_i + M_i} \cdot 100 \qquad (5)$$

now, B_i lies in the closed interval $[0, 200]$, and the corresponding trade flow positions are indicated as :

$$B_i = 0 \quad \underset{M = 0}{|} \quad X > M \quad \underset{X = M}{|} \quad X < M \quad \underset{X = 0}{|} \quad 0$$

And, in the light of the original expressions (1) and (2), Balassa has suggested a measure of the average inter-industry trade level in " n " industries[13], as :

$$\overline{A}_i = \frac{1}{n} \sum_{1}^{n} \frac{|X_i - M_i|}{X_i + M_i} \qquad (6)$$

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13 B. Balassa, " Tariff Reduction & Trade in Manufacturures among the Industrial Countries ", American Economic Review, June 1966, pp. 466-473.

However, this is an unweighted averagae of a set of A_{is}. The weighted average index will be[14] :

$$\bar{A}_i = \frac{\sum_1^n |X_i - M_i|}{\sum_1^n (X_i + M_i)} \cdot 100 \qquad (7)$$

Similarly, using equation (4), this becomes :

$$\bar{A}_i = \frac{\sum_1^n (X_i - M_i)}{\sum_1^n (X_i + M_i)} \cdot 100 \qquad (8)$$

By employing equation (8) in aggregating $(X_i - M_i)$, a portion of total values in trade will be cancelled out. Hence, an under-estimation of the average " trade level " is apparent. However, in case the number of items in aggregation is large and their trade directions are almost the same, equation (8) will provide an indication of both the level and direction of trade flows.

It is a characteristic of inter-industry trade level analysis that, $\bar{A}_i$ will be found increasing as we go from a

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14 Paul Luey, " Inter-Industry Specialization in International Trade : The Hong Kong Case ", Hong Kong Economic Papers, No.11, April 1977, pp. 22-23.

lower to a higher level of data aggregation[15], i.e.,

$$\bar{A}_i \leq \bar{A}_j$$

the subscripts denote the levels of aggregation where $i < j$.

Similarly, since the mean of B_i is originally given as :

$$\bar{B}_i = \frac{\sum_1^n \left[(X_i + M_i) - |X_i - M_i| \right]}{\sum_1^n (X_i + M_i)} \cdot 100 \qquad (9)$$

Then, using equation (5), this becomes ,

$$\bar{B}_i = \frac{\sum_1^n \left[(X_i + M_i) - (X_i - M_i) \right]}{\sum_1^n (X_i + M_i)} \cdot 100 \qquad (10)$$

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15 As an example, for the i^{th} industry, at a particular level of aggregation, X_i and M_i (correspond to $\bar{A}_i$) are each made up of the exports and imports of industries defined at a more disaggregate level, called X_{ij} and M_{ij} (correspond to $\bar{A}_{ij}$) respectivaly. We have,

$$\sum X_{ij} = X_i \text{ and } \sum M_{ij} = M_i$$

$$\text{so, } X_i + M_i = \sum X_{ij} + \sum M_{ij}$$

$$= \sum (X_{ij} + M_{ij})$$

by applying a formula of Inequality (i.e., $\left|\sum a_i\right| \leq \sum |a_i|$, where a_i are real numbers)

$$|X_i - M_i| \leq \sum |X_{ij} - M_{ij}|$$

then,

$$\frac{|X_i - M_i|}{X_i + M_i} \leq \frac{\sum |X_{ij} - M_{ij}|}{\sum |X_{ij} + M_{ij}|}$$

or,

$$\bar{A}_i \leq \bar{A}_{ij} \quad \#$$

And, considering the effects of aggregation on inter-industry trade level analysis, because the denominator in equation (10) is unaffected upon aggregation, it follows that the measure of intra-industry trade at a more aggregative level is greater than, or at least no less than, the measured intra-industry trade with a finer breakdown of in industry. In short, B_i will approach either 0 or 200 as more detailed breakdowns of an industry is employed in calculation.

In addition, such effects upon aggregations also apply to aggregations across countries[16]. At a certain level of SITC, the $\overline{A}_i$ of bilateral trade with individual countries, with each country weights determined by its share of the total export plus import levels, is greater than the measure of inter-industry trade between the country and the world. On the other hand, $\overline{B}_i$ (at a certain level of aggregation) of the measure on bilateral trade is less than the measure for intra-industry trade between the country and all the other countries combined.

Following the style of the original model presented in Figure 2, a simplified model in revealing product cycle trade under a bilateral commodity flows background is postulated below.

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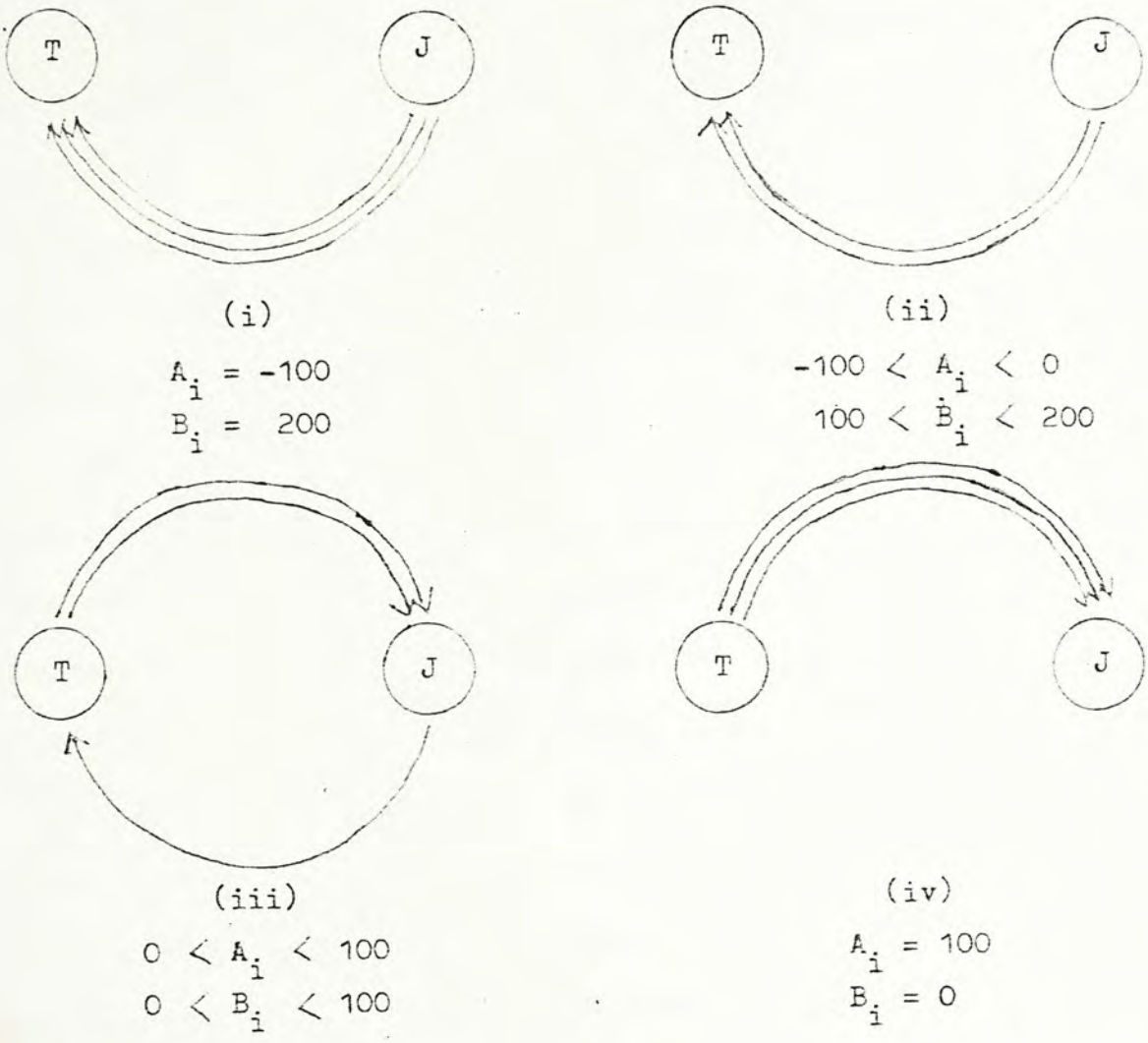
16 Such a feature is noted here in order to give a comparison between bilateral trade flows and overall trade flows under the inter- and intra-industry trade analyses towards a certain country. For further reference, please see H.G. Grubel & P.J. Lloyd, Intra-Industry Trade, London : Macmillan, 1975, pp. 23-24.

Figure 3

The Suggested Model



Note :

J : An industrial country, a creator of product cycles. Here Japan is referred.

T : A developing country, a catching-up of product cycles. Here Taiwan is referred.

A_i , B_i : The Inter-Industry Trade Level Index and the Intra-Industry Trade Level Index respectively as described.

⇒ : Large volume of trade flows,

⇒ : Medium volume of trade flows,

→ : Small volume of trade flows.

Our Figure 3 suggests that :

In phase (i), Japan is the only exporter of various products of a certain manufacturing industry, say C. From the stand-point of Taiwan, the inter-industry trade level index (A_i) of C will be -100 (i.e., X = 0). And, the corresponding intra-industry trade level index (B_i) of C will be 200, showing that there is no intra-industry trade for any product in industry C.

In phase (ii), some products in industry C are started to be produced in Taiwan. This alleviates the import dependence on Japan. However, in these days, demands of most of the products in C are still fulfilled by imports from Japan, especially when those more sophisticated versions are concerned. Accordingly, the A_i of C (from the stand-point of Taiwan) will be more than -100 but less than 0 (i.e, $M > X$). And, the corresponding B_i of C will be less than 200 but more than 100, showing that there exists intra-industry trade of industry C between the two countries. However, Japan is the net exporter.

In phase (iii), if the products in industry C, after mature, are labor-intensive or moderately capital-intensive, then, those products produced in Taiwan will be more and more competitive in both Taiwan's domestic market and Japan's market. More and more versions of C will be replaced by Taiwan products over time. The A_i of C, from the stand-point of

Taiwan, will be less than 100 but more than 0 (i.e., $X > M$). And, the corresponding B_i of C will be less than 100 but more than 0, showing that Taiwan is the net exporter in intra-industry trade of industry C.

In phase (iv), eventually (in the extreme case), Japan will stop her domestic production of industry C. Then, Taiwan will become the only exporter of the various products in industry C. Accordingly, from the stand-point of Taiwan, the A_i of C will be 100 (i.e., $M = 0$). And, the corresponding B_i of C will be 0, showing that there is no intra-industry tarde once again for products in industry C between the two countries.

CHAPTER IV

A BROAD INVESTIGATION OF TAIWAN-JAPAN BILATERAL COMMODITY FLOWS

4.1 The One-Digit SITC Inter-Industry Trade Level Indices, 1954 to 1975

In condusting trade flows analyses, it is usually recommended to use statistical data of exports and imports both in f.o.b. values or both in c.i.f. values so that bias can be avoided. Of the two, f.o.b. valuation is preferable since it measures the value of trade produced by producers in each industry, while excluding the values added by transporters and traders. Unfortunately, trade data available are generally prepared by a country in f.o.b. values for her exports but c.i.f. values for her imports. In this respect, the trade level will be biased upwards.

Concerning our case, since we employ mainly Japanese trade data, exports of Taiwan to Japan will somehow be overstated. Fortunately, owing to the geographic proximity of the two places, bias are considered to be admittable. However, at the one-digit level calculations, we employ both f.o.b. values[1].

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[1] The method is: if comparable (i.e., amounts given in the same currency, records are taken in the same time period, commodities are classified under the same system) trade data are available in both countries, we can then retain each country's export (f.o.b.) values as this country's export data, and her trade partner's export (f.o.b.) values are taken as her import data. So, the country's trade flow data are now both in f.o.b. values.

Initially, we shall produce the one-digit level inter-industry trade level indices (A_i) and inspect changes in the trade pattern between the bilateral partners.

As a matter of fact, according to the arguments of the product cycle model, we may just concentrate our interest on the SITC 5 to 8 sections. But in order to have a more complete picture of the bilateral trade flows, we shall present the results of all the one-digit sections.

As a guide-line for evaluating our results that follow, it is defined that the inter-industry specialization is high, moderate, or low, depending on whether the absolute value of the measured level of inter-industry trade is greater than or equal to 75, between 75 and 50, and equal to or less than 50 respectively[2].

In addition, although our main interest of analysis is on the direction and net level of trade flows, we shall refer to Appendix 4.1 to reveal the actual trade figures whenever required.

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2 These criteria were suggested by Paul Luey in his " Inter-Industry Specialization in International Trade : The Hong Kong Case ", in Hong Kong Economic Papers, No. 11, April 1977, p. 24.

Table 4.1

Taiwan's Inter-Industry Trade Level Index (vis-a-vis Japan)
at One-Digit SITC (1954 to 1975)

Year	SITC Sections 0	1	2	3	4	5	6	7	8	9
1954	74.6	---	64.7	---	-100.0	- 96.6	- 96.3	-100.0	- 81.7	---
55	91.9	---	52.1	11.7	-100.0	- 95.7	- 97.7	-100.0	- 65.4	- 38.9
56	90.4	33.3	- 14.3	11.5	- 84.7	- 94.7	- 86.7	-100.0	- 97.2	- 71.4
57	94.1	---	- 40.4	35.1	- 60.0	- 96.0	- 98.1	-100.0	- 94.9	- 94.4
58	97.1	---	3.0	32.6	27.7	- 98.0	- 98.5	-100.0	- 97.9	- 98.6
59	95.7	100.0	14.0	18.7	- 29.8	- 94.3	- 98.2	-100.0	- 99.5	- 95.9
1960	91.6	- 83.3	22.9	14.4	- 82.9	- 73.6	- 99.6	-100.0	- 98.8	- 97.9
61	90.4	100.0	- 21.5	32.2	- 87.5	- 80.0	- 97.5	- 99.9	- 92.5	-100.0
62	91.6	100.0	- 26.4	- 16.7	100.0	- 89.6	- 98.5	- 99.9	- 83.4	---
63	96.3	100.0	- 12.0	- 4.0	- 39.8	- 79.5	- 97.9	-100.0	- 71.8	100.0
64	96.2	100.0	- 8.5	- 41.6	- 20.4	- 82.0	- 97.0	- 99.9	- 72.2	- 96.0
65	95.7	100.0	- 6.5	- 99.1	100.0	- 88.3	- 98.2	- 99.7	- 79.7	- 81.4
66	93.5	100.0	15.0	4.0	- 65.9	- 90.9	- 97.6	- 98.4	- 82.3	- 83.9
67	88.8	- 91.8	5.1	- 2.1	- 75.1	- 89.9	- 93.1	- 98.0	- 69.9	- 74.2
68	85.6	- 80.7	- 8.6	- 12.5	- 54.2	- 94.4	- 85.6	- 98.1	- 67.5	- 88.7
69	80.2	100.0	- 20.0	- 8.4	- 67.6	- 93.9	- 86.9	- 94.5	- 47.7	- 89.0
1970	75.7	100.0	- 2.0	- 19.3	- 75.4	- 92.0	- 70.5	- 89.9	- 10.0	- 91.0
71	74.3	47.8	- 34.1	- 40.2	- 90.1	- 92.3	- 83.2	- 93.3	- 8.6	- 92.7
72	77.9	69.9	- 11.9	- 1.4	- 93.6	- 91.0	- 69.7	- 89.4	1.5	- 74.9
73	77.8	79.9	- 27.9	- 27.8	- 90.8	- 83.4	- 43.3	- 85.0	30.0	- 93.1
74	76.1	88.9	- 38.7	- 68.0	- 80.2	- 77.8	- 64.7	- 81.7	35.9	- 94.6
75	73.6	90.3	- 35.4	- 75.5	- 61.0	- 89.7	- 73.1	- 79.7	20.6	- 99.2

Source : Commodity Trade Statistics, United Nations, 1962 - 1970;
Japan Exports and Imports, 1971-1975. Absolute trade figures are found in Appendix A-4.1.

Note : These indices are viewed in the position of Taiwan, i.e., A_i refers to net exports of Taiwan and $-A_i$ refers to net imports of Taiwan.

" --- " indicates no record of data.

From Table 4.1, it is observed that, among all traded commodities, Taiwan has been continuously a net exporter (to Japan) only in SITC section 0. This section contains mainly foodstuffs, Such as : livestock, meat, rice, cereal, wheat, sugar, fruit, fish, milk, egg, vegetables, coffee, cocoa, tea, and food prep. nes (not else specified) etc. Among them, sugar and food prep. nes are important exportables of Taiwan. Anyhow, these are Ricardo Goods where their pattern of trade flows can well be explained by the Law of Absolute Advantage. As a whole, in the fifties, the exports of all section 0 items were usually amounted to more than 90% of Taiwan's total exports (SITC 0 to 9) to Japan. However, the corresponding percentage has dropped to 80 in 1965, then to 70 in 1968, and to 40 or so in 1972. Lastly, at the end of the period, it was only around 30. This shows that Taiwan has released from her backwardness of export dependence on primary goods.

For section 1, it contains only four industries, i.e., beverages nonalc., beverages alc., tobacco unmfd., and tobacco mfs. As a whole, the export and import values (vis-a-vis Japan) are all below 0.5% of total exports or total imports (again, vis-a-vis Japan). In addition, since the production and trading of beverage and tobacco is a nationalized business in Taiwan, the trade flows of the commodities in this section are less important to the present study.

Concerning section 2 and section 3 which contain raw materials and fuels like coal, petroleum, cotton, fuelwood, charcoal, rubber, and veg. fibres etc., Taiwan was initially a net exporter (vis-a-vis Japan) of the goods in these sections. But later on, she became a net importer. This reveals that, due to Taiwan's undertaking of her development process, her domestic demands of these materials and fuels have substantially increased so that she have to import from other countries instead.

Similar to that of section 1, section 4 contains a few industries in producing mainly animals and vegetables oils and fats. Again, since the corresponding export and import values (vis-a-vis Japan) are rather insignificant, this section is also less important to our analyses.

As we have indicated, the SITC 5 to 8 sections are the manufactured goods. These commodities constitute our main interest of investigation. From Table 4.1, we observed that for section 5, 6, and 7, Taiwan was continuously a net importer, though, at a decreasing rate. That is, for section 5, the initial position of A_i = -96.6 to a level of -87.7; for section 6, from that of -96.3 down to -73.1; and for section 7, from that of -100.0 down to -79.7. Clearly, since sections 5 to 7 contain mainly those capital-intensive and/or technology-intensive commodities of chemical products, basic manufactures, machineries and transport equipments, we

cannot expect Taiwan to acquire so quickly the competitiveness in their production and exportation. The mentioned decrease in their respective trade level is well enough to indicate that production and some import-substitution have taken place.

Coming to the trade records of section 8, we got a more notable outcome. The corresponding trade level has changed from the initial value of -81.7 to that of 20.6. This revealed that Taiwan has changed from her net importer position into a net exporter position in those miscellaneous manufactured goods in her bilateral trade with Japan.

Another worth mentioning feature is the structural changes observable in our bilateral trade case as seen in the following table.

Table 4.2

Changes in the Proportions of Taiwan's Exports of Manufactures to Japan

Period	$\frac{X_{\text{sections 5-8}}}{X_{\text{all items}}} \cdot 100$	$\frac{X_{\text{section 8}}}{X_{\text{all items}}} \cdot 100$
1954-1959	1.9	0.3
1960-1964	3.3	0.4
1965-1969	7.5	1.7
1970-1975	42.1	17.3

Source : Same as Table 4.1

Note : $X_{\text{section 8}}$ - Amounts of exports of Taiwan to Japan of SITC section 8.

$X_{\text{section 5-8}}$ - Amounts of exports of Taiwan to Japan of SITC sections 5 to 8 as a whole.

$X_{\text{all items}}$ - Total amounts of exports of Taiwan to Japan.

Table 4.2 provides us with the evidence to support our arguments in Chapter Three that Taiwan's exports to Japan have undergone substantial structural changes. Taiwan's exports of SITC section 5 to 8 have increased from an initial 1.9% to 42.1% of her total exports. The exports of section 8 in particular have increased from 0.3% to 17.3%. These indicate that the trade-oriented growth economy like Taiwan has managed to shift her exports from the initial primary goods to that of manufactured goods even in a highly competitive and protected market like Japan.

Based upon these findings, we shall inspect further into the 3-digit level inter-industry trade flow records in order to find out what exactly are the products that have exhibited the product cycle trade experiences.

4.2 The 3-digit SITC Inter-Industry Trade Level Indices, 1962 to 1975

In economic analysis, the term " industry " is usually defined as " a group of firms producing a homogeneous commodity ". As what economists have chosen in empirical studies on commodity trade flows, the 3-digit SITC[3] statistical data do appear to separate commodities into groups

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3 The descriptions of the SITC 3-digit groupings have been given in Chapter Three.

most closely correspond to the concept of an "industry". But in fact, even when industries are defined in terms of 6-digit commodity items, they may still produce more than one product. Such a shortcoming of the available trade data sets a limitation to the study of product cycle trade in particular. Anyway, we shall follow the usual practice in using the 3-digit data for our further investigations on the bilateral commodity flows.

As a general case, let us consider for instance that product "Z" is one of the substitutes making up a given industry's spectrum of products differentiated by quality or style. Our hypothesis is: in the extreme case, it may be assumed that Taiwan imports initially a certain proportion of the differentiated goods in the spectrum from Japan, including Z. Whilst Taiwan produces some domesticaaly, none are exported during static equilibrium up to time t_0. After domestic production had once been started, imports of Z are reduced and, at time t_1, exports developed. Between time t_1 and time t_2 later, Taiwan's statistics will show intra-industry trade consisting of the exports of Z and the contirued imports of the Z substitutes. Accordingly, some traded products would exhibit the experience (in terms of A_i) as:

1. From -100 or -a, to -b;
2. From -100 or -a, to c or 100

where (i) a, b and c are values of A_i each being less than 100,

(ii) a is larger than b,

(iii) c is larger than or less than a.

Table 4.3

A 3-digit level A_i on SITC sections 5-8 in selected years

SITC Code	Year 1962	1970	1975
512	-100.0	- 94.1	- 88.2
513	-100.0	-100.0	- 93.1
514	-100.0	-100.0	- 93.0
515	---	---	- 80.0
521	---	---	-100.0
531	-100.0	-100.0	- 90.8
532	---	---	- 76.7
533	-100.0	-100.0	-100.0
541	-100.0	- 93.0	- 30.0
551	100.0	42.8	17.4
553	---	---	55.4
554	-100.0	-100.0	- 99.7
561	-100.0	-100.0	-100.0
571	-100.0	100.0	98.0
581	-100.0	-100.0	- 99.3
599	-100.0	-100.0	- 86.3
$\bar{A}_{i(5)}$	- 90.0	- 91.7	- 61.9
611	---	-100.0	- 98.0
612	---	33.7	67.7
613	---	---	- 5.5
621	---	-100.0	- 88.1
629	-100.0	-100.0	- 51.2
631	---	100.0	93.7
632	---	100.0	98.8
633	---	---	100.0
641	-100.0	-100.0	- 88.2
642	-100.0	-100.0	- 42.2

Table 4.3 (cont.)

A 3-digit level A_i on SITC sections 5-8 in selected years

SITC Code	Year 1962	1970	1975
651	-100.0	- 59.9	- 67.3
652	-100.0	55.8	39.3
653	-100.0	- 89.4	- 77.8
654	---	-100.0	- 47.9
655	-100.0	- 74.8	- 76.9
656	---	29.3	92.4
657	---	100.0	95.8
661	---	26.5	58.8
662	-100.0	- 70.5	- 68.9
663	-100.0	- 76.7	- 68.4
664	---	- 87.1	- 65.9
665	---	-100.0	60.8
666	-100.0	-100.0	14.2
667	---	---	- 53.5
671	---		45.6
672	---		08.9
673	-100.0		
674	-100.0	-100.0	
675	-100.0	-100.0	-100.0
676	---	-100.0	-100.0
677	-100.0	-100.0	-100.0
678	-100.0	- 91.2	- 97.2
679	---	---	0.1
681	---	-100.0	- 98.4
682	-100.0	- 84.9	- 85.9
683	---	-100.0	- 94.0
684	---	- 31.7	- 76.1
685	---	-100.0	- 57.1
686	---	-100.0	-100.0
687	---	-100.0	-10

Table 4.3 (cont.)

A 3-digit level A_i on SITC sections 5-8 in selected years

SITC Code	Year 1962	1970	1975
689	---	-100.0	- 99.5
691	-100.0	-100.0	- 96.7
692	-100.0	-100.0	- 97.3
693	-100.0	-100.0	- 96.5
694	---	-100.0	- 92.0
695	-100.0	-100.0	- 91.5
696	---	-100.0	- 90.8
697	---	-100.0	57.2
698	-100.0	- 87.4	- 71.5
$\bar{A}_{i(6)}$	-100.0	- 70.3	- 68.3
711	-100.0	- 98.1	- 93.8
712	-100.0	-100.0	- 99.1
714	-100.0	- 43.8	- 34.8
715	-100.0	- 95.3	- 91.5
717	-100.0	-100.0	- 96.5
718	-100.0	- 95.3	- 98.4
719	-100.0	- 98.9	- 96.8
722	-100.0	- 82.3	- 75.1
723	-100.0	-100.0	- 55.9
724	-100.0	- 87.0	- 53.3
725	-100.0	-100.0	37.8
726	---	-100.0	-100.0
729	-100.0	- 66.8	- 53.9
731	-100.0	-100.0	- 86.1
732	-100.0	-100.0	- 99.2
733	-100.0	-100.0	- 89.4
734	---	-100.0	-100.0
735	- 94.4	-100.0	- 97.9
$\bar{A}_{i(7)}$	- 99.3	- 89.1	- 77.7

Table 4.3 (cont.)

A 3-digit level A_i on SITC sections 5-8 in selected years

SITC Code	Year 1962	1970	1975
812	---	- 2.1	- 72.2
821	---	33.9	96.6
831	---	100.0	95.2
841	---	100.0	98.8
842	---	---	46.7
851	---	100.0	99.5
861	-100.0	- 84.1	- 50.9
862	-100.0	-100.0	-100.0
863	-100.0	- 31.8	- 62.4
864	-100.0	- 53.9	- 57.7
891	-100.0	-100.0	- 77.5
892	-100.0	- 67.2	- 2.0
893	---	- 51.4	29.5
894	---	- 0.2	56.6
895	-100.0	3.0	2.4
896	---	100.0	96.5
897	---	100.0	71.6
899	-100.0	40.0	58.3
$\bar{A}_{i(8)}$	-100.0	- 7.5	23.8
$\bar{A}_{i(5-8)}$	- 98.5	- 76.2	- 58.3

Source : Commodity Trade Statistics, United Nations, 1962, 1970; Japan Exports and Imports, 1975. Absolute trade figures are found in Appendix A-4.3

Note : $\bar{A}_{i(x)}$: Average inter-idustry trade level index.

The results presented in Table 4.3. have provided a more detailed interpretation to our bilateral flows of manufactured commodities. From the results, it is found that the supplies (to Taiwan) of a lot of products are still depending much on imports from Japan. These include both the Ricardo Goods like 515 (radioact etc. mat.), 611 (leather), 667 (gems etc.), 681 (silver etc. metal), 684 (aluminium), 686 (zinc), 687 (tin); and, the capital and/or technology-intensive products: 521(tar or coal chem), 533 (paints etc.), 561 (fertilizers mfd.), 581 (plastic material), 672 (primary steel etc.), 673 (shapes, iron & steel), 674 (plates, iron & steel), 675 (hoop strip), 676 (railway rails etc.), 677 (wire, iron & steel), 678 (pipes, iron & steel), 689 (base metal nes), 691 (construction metal), 692 (containers metal), 693 (wire prod nonel), 712 (agriculture machines), 717 (textile etc. mach.), 718 (machines fr spec ind.), 719 (machinery nes), 726 (elec medical equi.), 732 (road motor veh.), 734 (aircraft), 735 ships & boats), 812 (building fixtures) and 862 (photo goods). However, although not significant, the trade level indices of these products have more or less declined. This indicates that domestic productions in Taiwan have been taken place, and , a small scale of exports has been developed. In fact, following the pace of development in Taiwan, it is likely that more of the above listed products will gradually be replaced by domestic productions. For instance,

the setting up of production units in plastic materials will soon improve the trade position of item 581. And more important, upon the establishing of Taiwan's Iron & Steel Refining Plans, the trade positions of a lot of iron & steel products like items 672, 673, 674, 675, 676, 677, 678, 689, 691, 692 and 693 are expected to improve as well.

On the other hand, Taiwan has been continuously a net exporter in commodities such as: 551 (essential oils), 612 (mfs. leather etc.), 631 (veneer plywood etc.), 632 (wood mfs nes), 657 (rugs lino etc.), 821 (furniture etc.), 851 (footwear), 896 (art works etc.), 897 (gold,silver wares). However, these are only those labor-intensive handicrafts such as wood manufactures, rugs & line, furnitures, art works, gold, silver wares; as well as some Ricardo Goods like essential oil, veneer plywood, etc.

However, our results has also revealed that, among the 101 industries within the SITC 5-8 sections, 19 are found to have experienced the changes in trade position from a net importer to a net exporter. These are industries 553 (perfume cosmetic), 571 (explosives), 633 (cork mfs.), 652 (cotton fabrics), 656 (made up textiles), 661 (lime cement etc.), 665 (glass ware), 666 (pottery), 671 (pig iron etc.), 679 (casting iron & steel), 697 (housewares metl.), 725 (domestic electric equip.), 831 (handbags etc.), 841 (clothes not fur), 842 (fur clothes etc.), 893 (plastic mfs nes), 894 (toys etc.), 895 (stationery etc.),

and 899 (mfd good nes). In order to have more definite evidence upon these suspected changes, we shall refer to a detailed time series of A_i of these industries.

Table 4.4

Product Cycle Trade Commodities

SITC Code	1962	1963	1964	1965	1966	1967	Year 1968	1969	1970	1971	1972	1973	1974	1975
553	---	---	---	---	---	---	---	---	---	- 50.0	1.2	44.4	52.2	55.4
571	-100.0	-100.0	---	---	-100.0	-100.0	-100.0	---	-100.0	36.3	60.3	94.4	92.4	98.0
633	---	---	---	---	---	---	---	---	---	- 50.5	-100.0	- 82.6	- 42.9	100.0
652	-100.0	-100.0	-100.0	-100.0	-100.0	2.3	68.7	55.6	55.8	48.7	85.6	78.3	53.4	13.1
656	---	---	---	---	-100.0	---	---	---	29.3	70.4	85.3	93.9	93.8	92.4
661	---	---	---	---	---	---	---	-100.0	26.5	38.7	80.0	93.9	84.8	58.8
665	---	---	---	---	---	---	---	---	-100.0	- 44.3	- 30.0	10.3	48.6	60.8
666	-100.0	---	-100.0	---	-100.0	-100.0	-100.0	-100.0	-100.0	- 91.9	- 52.0	- 12.1	- 34.9	14.2
671	---	---	---	---	-100.0	- 39.8	-100.0	-100.0	46.1	- 74.3	- 9.8	- 67.4	61.6	45.6
679	---	---	---	---	---	---	---	---	---	- 28.7	- 41.6	- 22.7	30.3	0.1
697	---	---	---	---	---	---	---	-100.0	-100.0	- 47.0	35.9	80.6	70.7	57.2
725	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	- 88.3	- 29.6	- 33.8	- 35.1	37.8
831	---	---	---	---	---	---	---	-100.0	100.0	- 24.2	10.1	23.7	62.6	95.2
841	---	---	---	---	- 70.3	100.0	100.0	100.0	100.0	99.1	98.9	99.5	98.7	98.8
842	---	---	---	---	---	---	---	---	---	- 55.1	- 51.7	33.0	1.8	46.7
893	---	---	-100.0	-100.0	-100.0	-100.0	-100.0	- 60.	- 51.4	- 8.9	0.3	19.4	47.2	29.5
894	---	---	---	-100.0	-100.0	-100.0	-100.0	- 30.	- 0.2	8.2	35.5	52.8	58.4	56.5
895	-100.0	-100.0	-100.0	-100.0	-100.0	- 22.8	-100.0	-100.	- 1.8	- 22.3	3.4	- 28.0	- 30.5	2.4
899	-100.0	- 35.6	29.4	- 51.6	20.9	27.2	17.5	18.	40.0	49.5	43.2	57.5	58.3	58.3
$\bar{A}_{i(19\ items)}$	-100.0	- 80.8	- 76.7	- 78.6	- 68.7	- 17.0	- 10.5	14.	56.9	55.9	68.3	79.9	81.4	73.5

Source : Same as Table 4.3 . Absolute trade figures are found in Appendix A-4.4

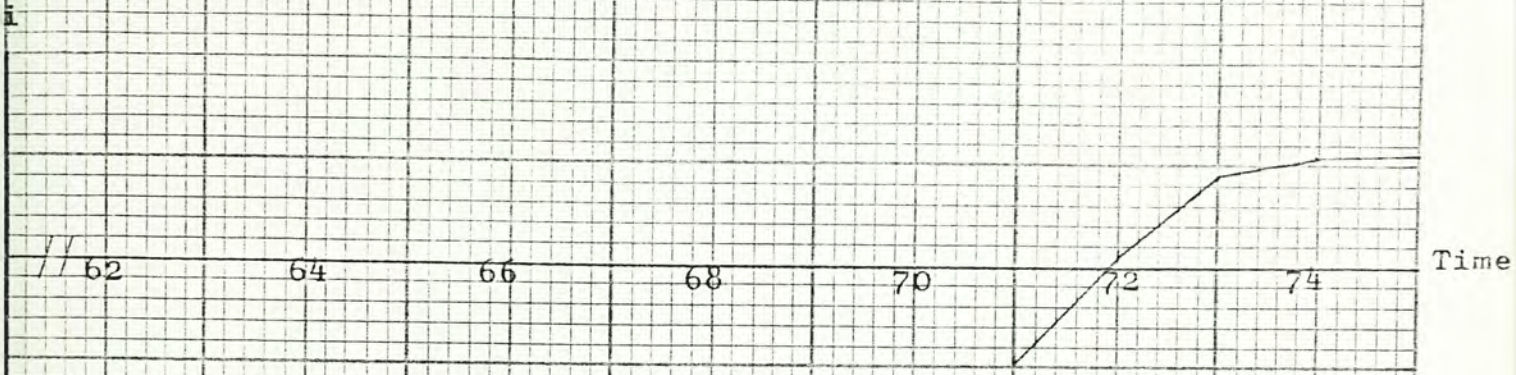
Commodities produced within these nineteen industries are mainly standardized manufactures. The textile products (652, 656), clothes & garments (841), handbags (831), cork manufactures (633), pottery (666), stationery (895) and other manufactured goods not else specified (899) are all typical labor-intensive products. On the other hand, metallic housewares (697), perfume cosmetics (553), plastic products (893), glasswares (665), pig iron (671), casting iron & steel (679), as well as the domestic electric equipments (725) are standardized products that require comparatively more capital inputs. As a whole, these are manufactures that a developing country can generally possess comparative advantage in their production and exportation. Following her pace of development, Taiwan's acquiring of competitiveness in these products is rather natural. In fact, the timing that these nineteen industries have changed from a net importer to a net exporter (even in a highly competitive market like Japan) have given supports to such an inter-relationship. From 1966 onwards, such changes have taken place initially in those products commonly manufactured for import-substitution such as manufactures not else specified (899), clothes not fur and cotton fabrics (841, 652); explosives (571), madeup textiles (656) and lime cement (661). Then in the 1970's, these were followed by the productions of various standardized commodities for the purposes of import-substitution on one hand,

and export-expansion on the other. They included: toys etc. (894),metallic housewares (697), handbags etc. (831), perfume cosmetics (553) and plastic manufactures not else specified (893), fur clothes etc. (843), and glassware (665). And recently, those comparatively more capital-intensive mature products are developed into exportables. They are: pig iron,etc. and casting iron & steel (671, 679), cork manufactures (633), domestic electric equipments (725), pottery and stationery (666, 895) etc.

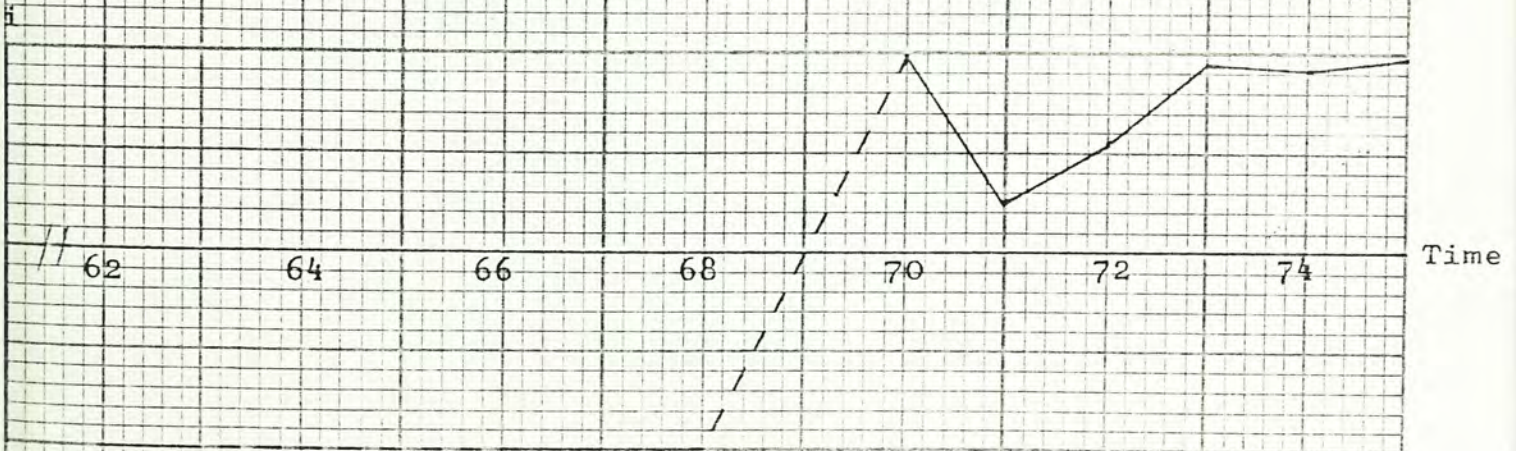
In order to illustrate more clearly the timing of the occurrence, accomplishment, as well as the characteristics of each "product cycle trade" incurred by the corresponding "product cycle good", a set of nineteen figures are drawn accordingly.

Figure 4

A Graphical Illustration of the Product Cycle Commodities in Trade between Taiwan and Japan

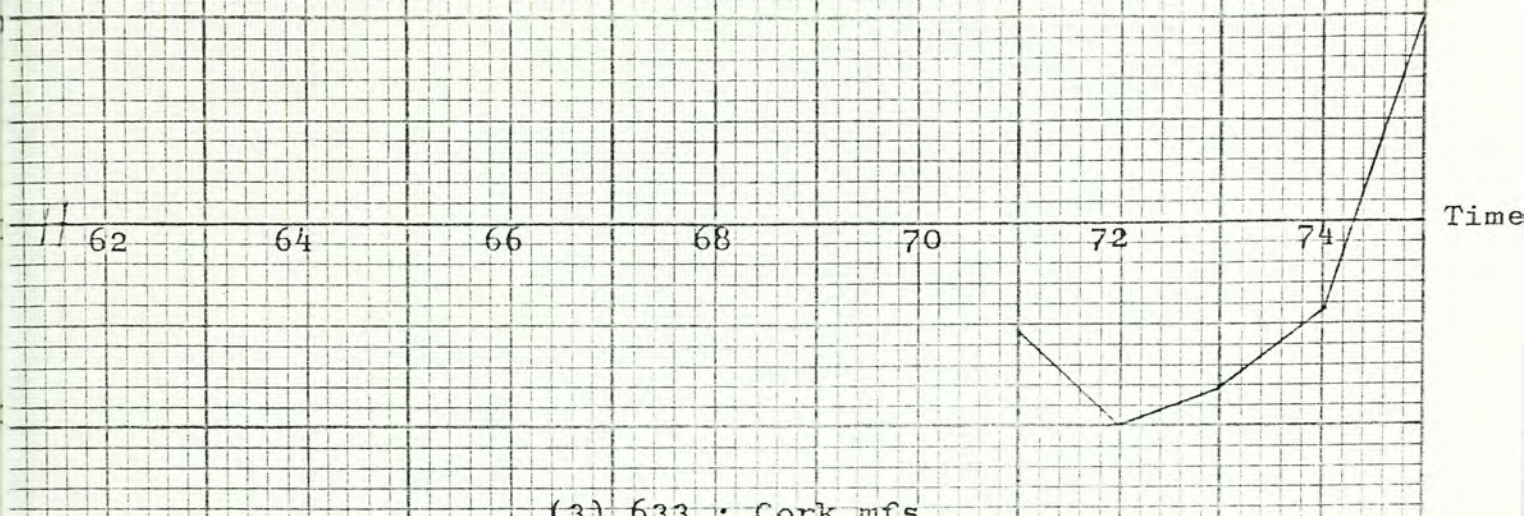


(1) 553 : Perfume cosmetic

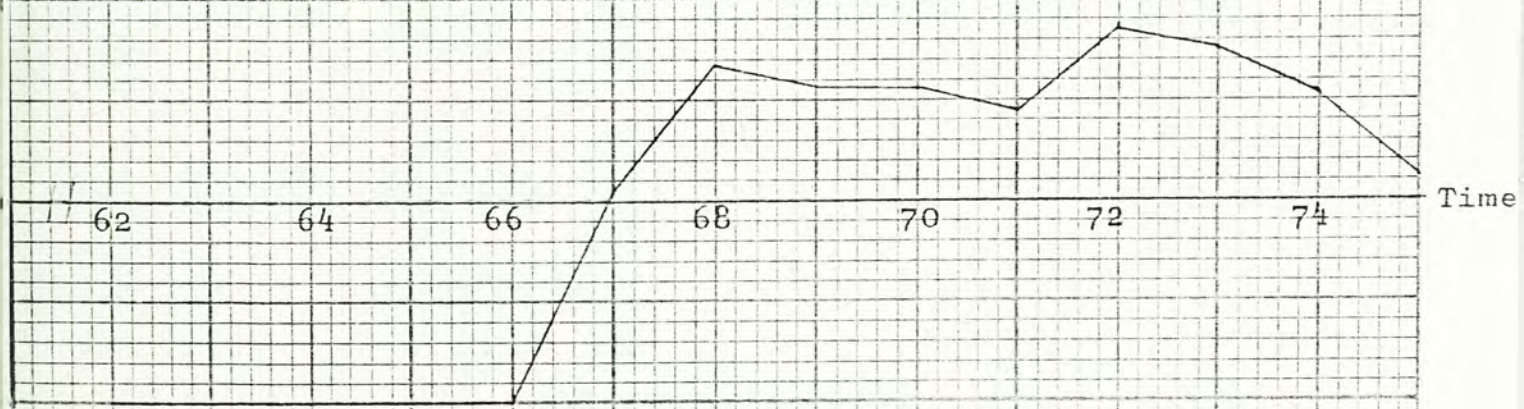


(2) 571 : Explosives etc.

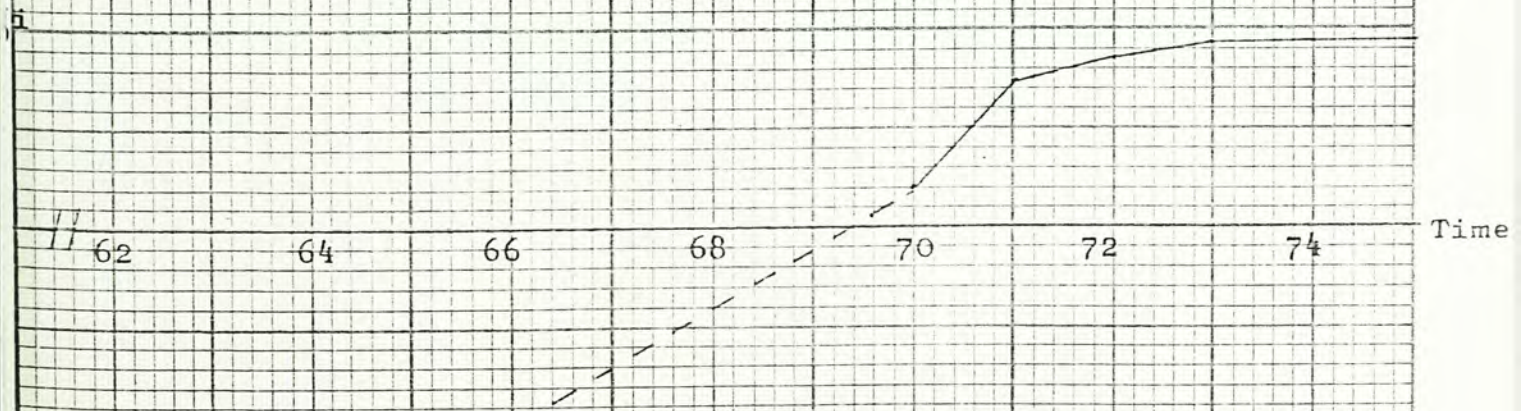
Figure 4
(cont.)



(3) 633 : Cork mfs

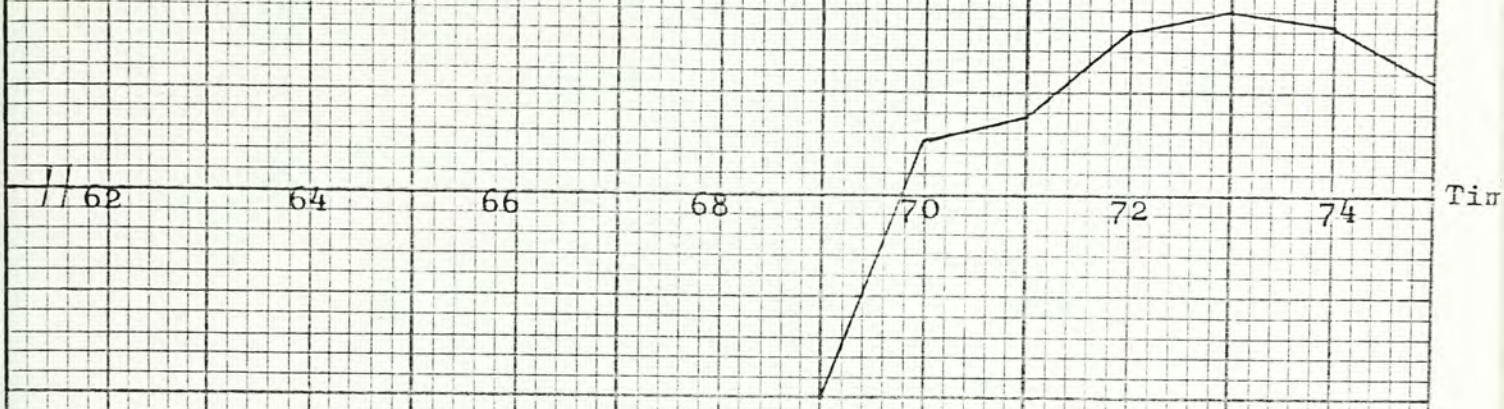


(4) 652 : Cotton fabrics

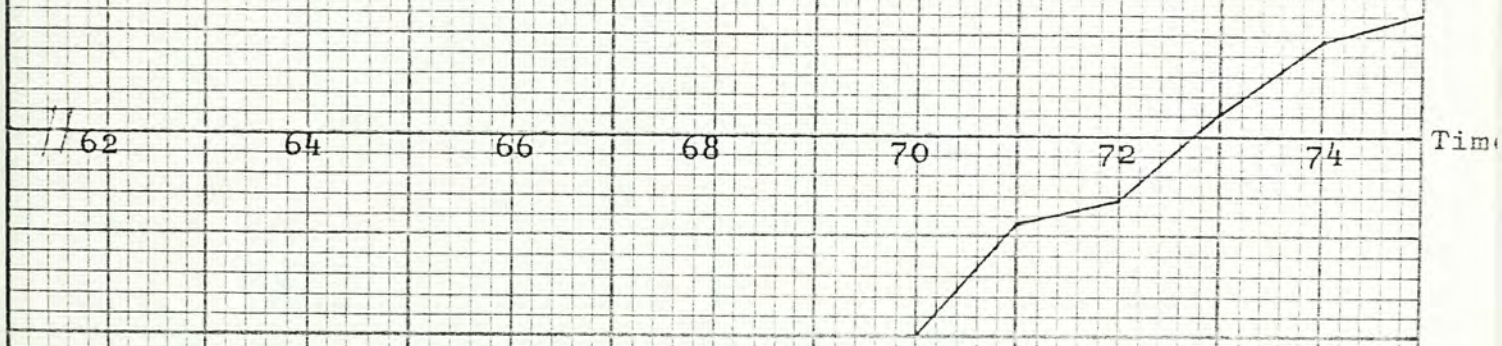


(5) 656 : Madeup Textiles

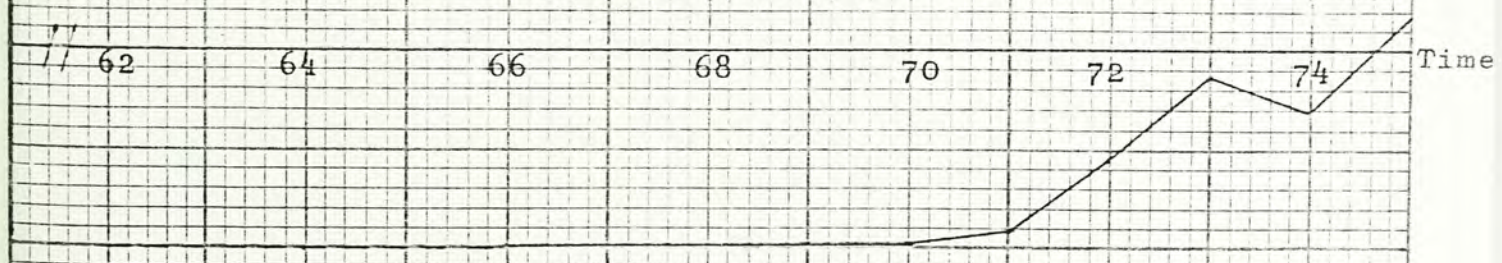
Figure 4
(cont.)



(6) 661 : Lime cement etc.

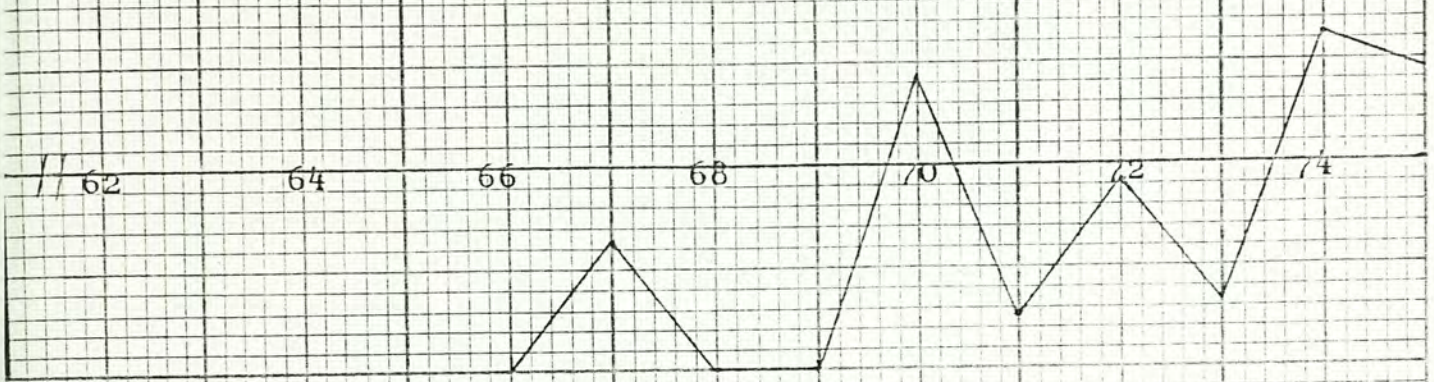


(7) 665 : Glassware

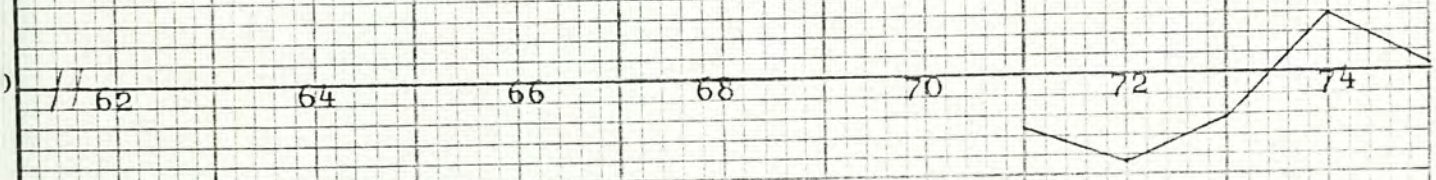


(8) 666 : Pottery

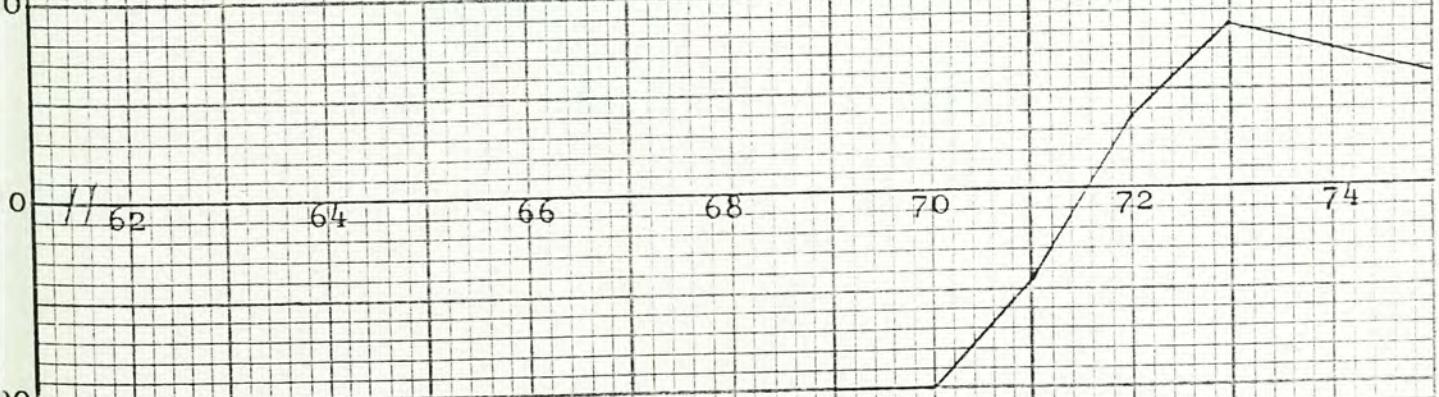
Figure 4
(cont.)



(9) 671 : Pig iron etc

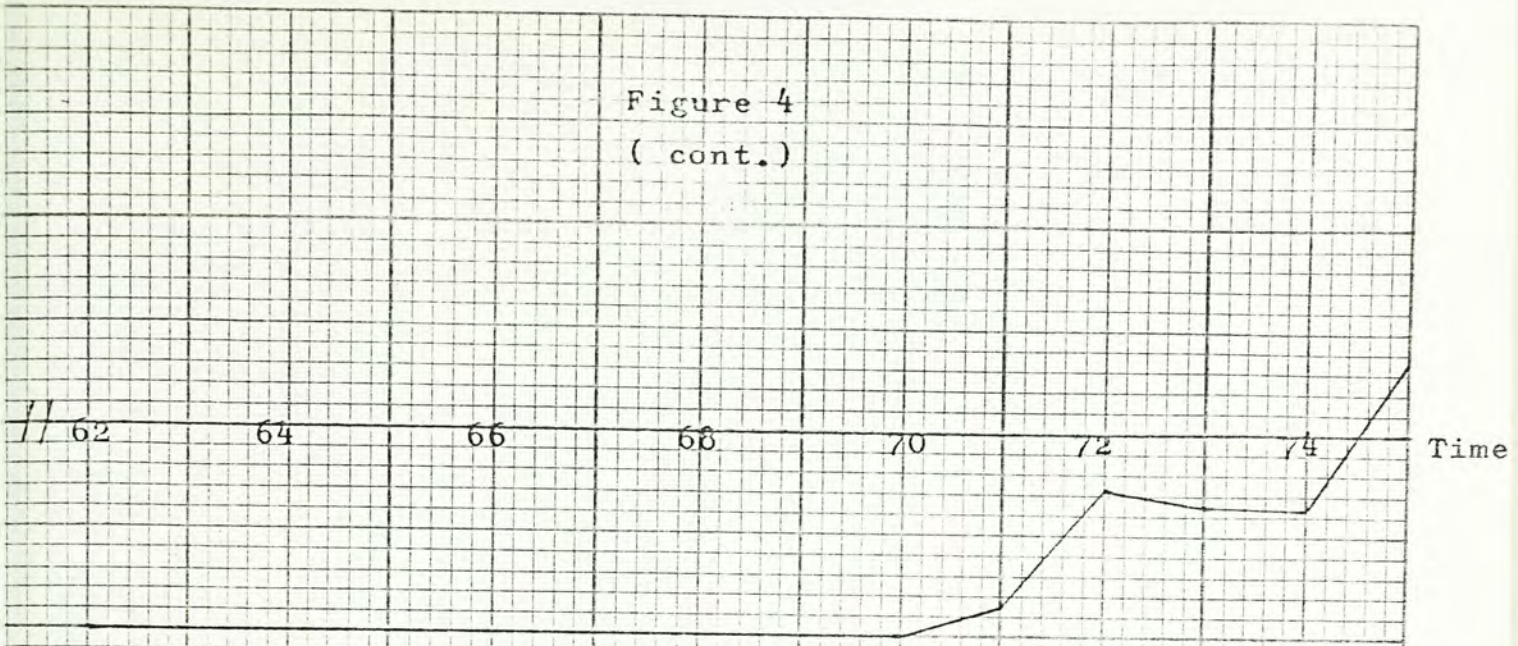


(10) 679 : Castings irn stl

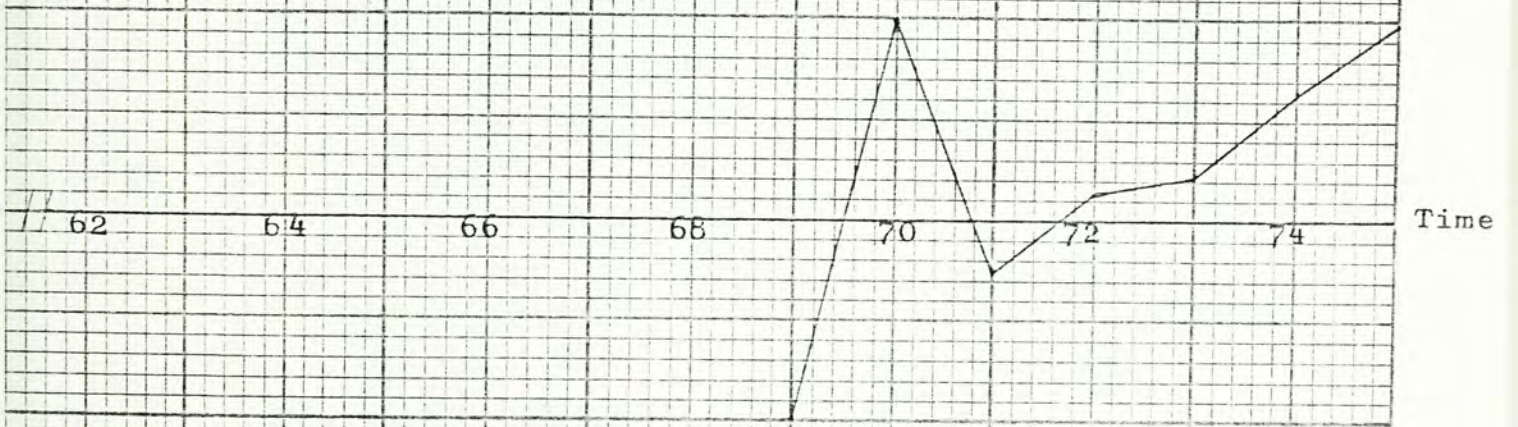


(11) 697 : Housewares metl

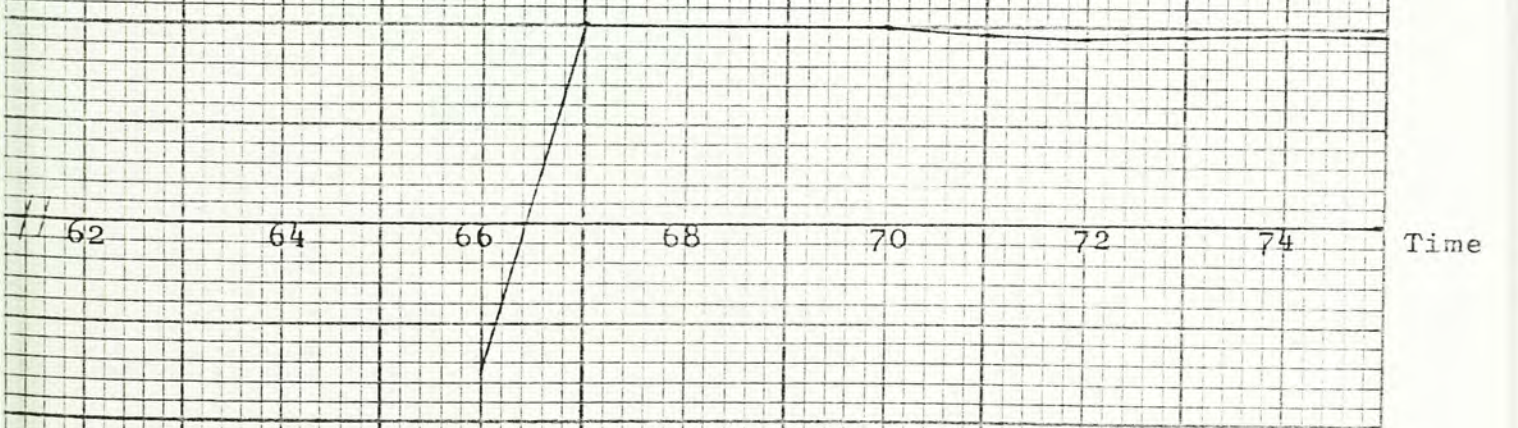
Figure 4
(cont.)



(12) 725 : Domestic elec equip

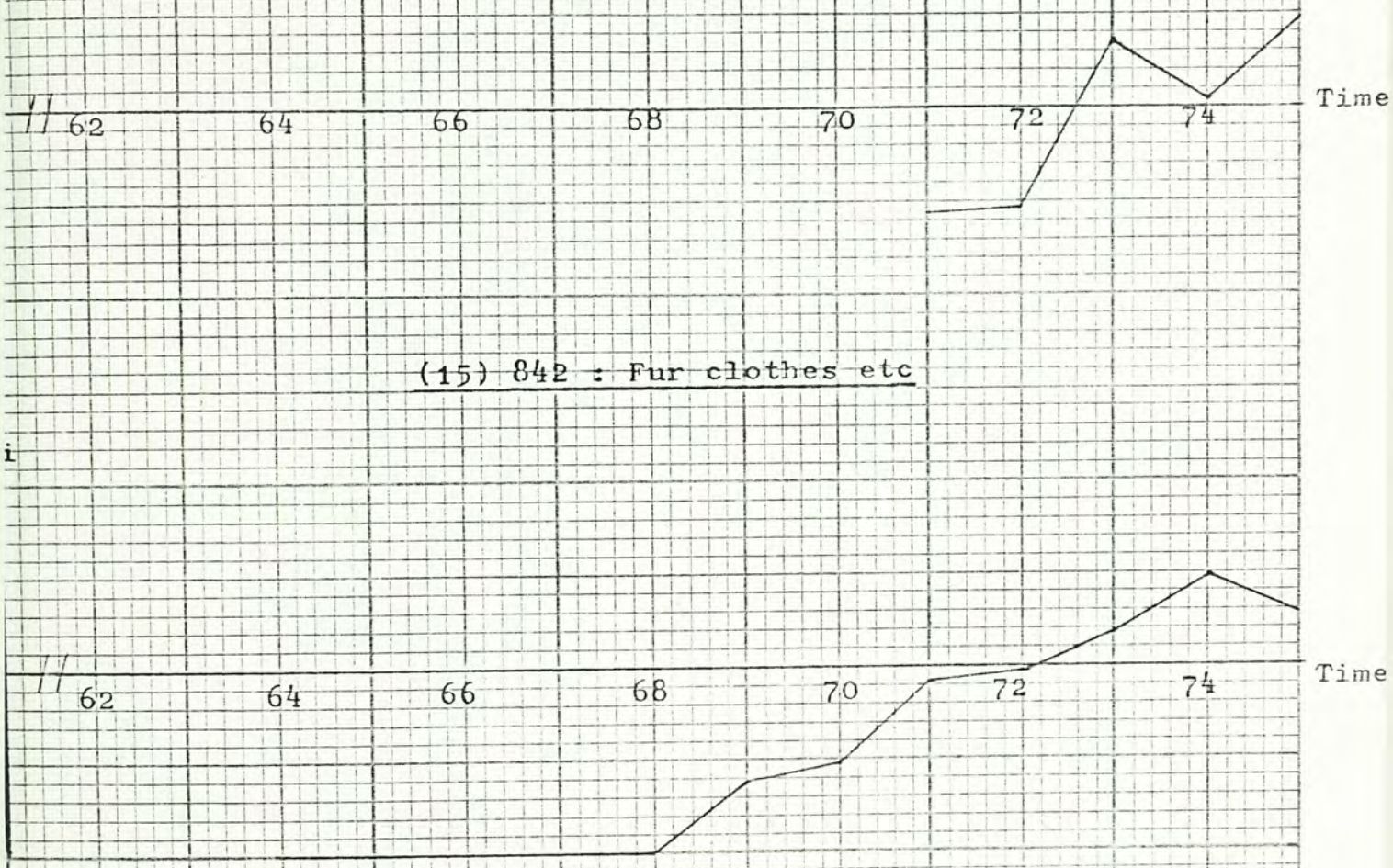


(13) 831 : Handbags etc

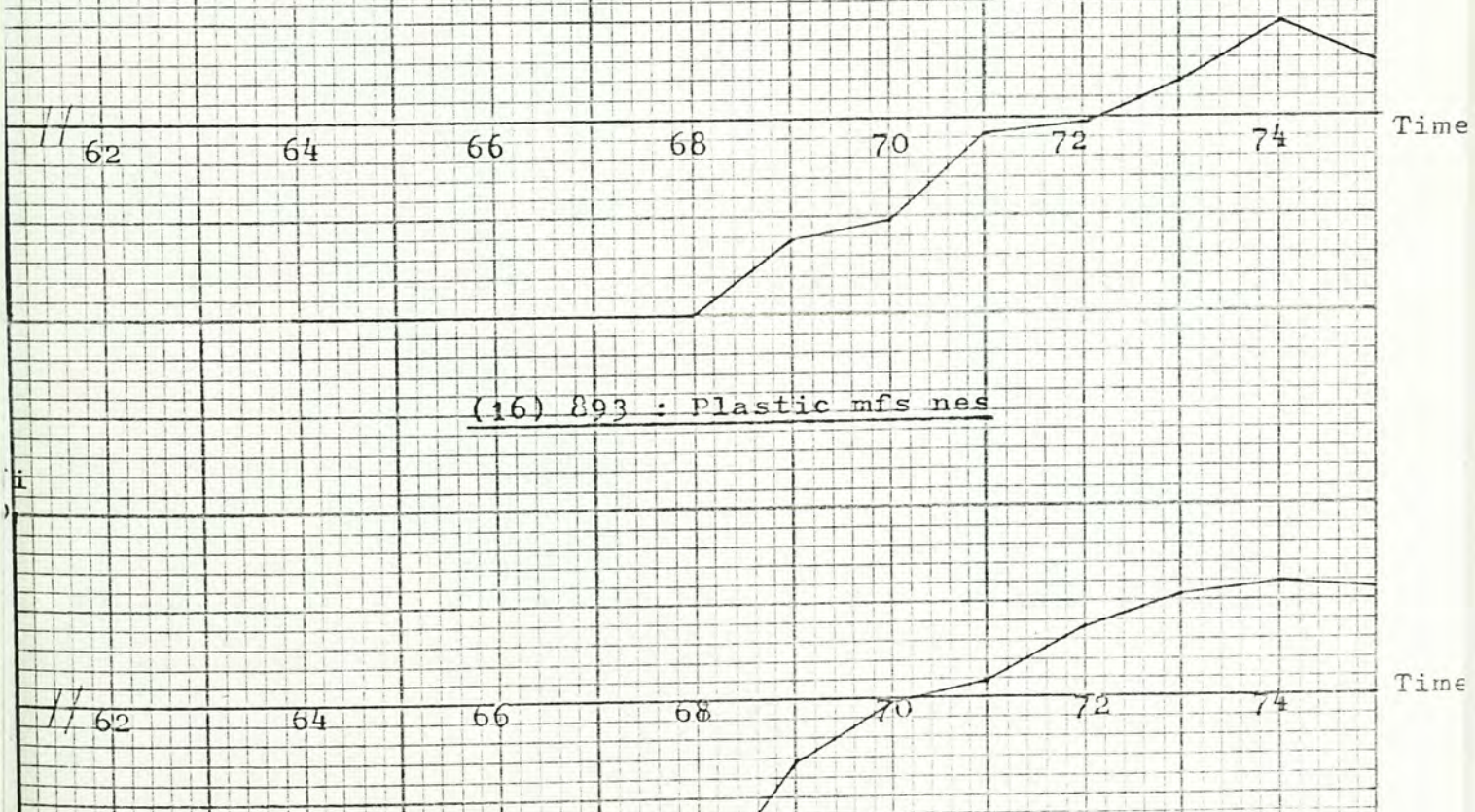


(14) 841 : Clothes not fur

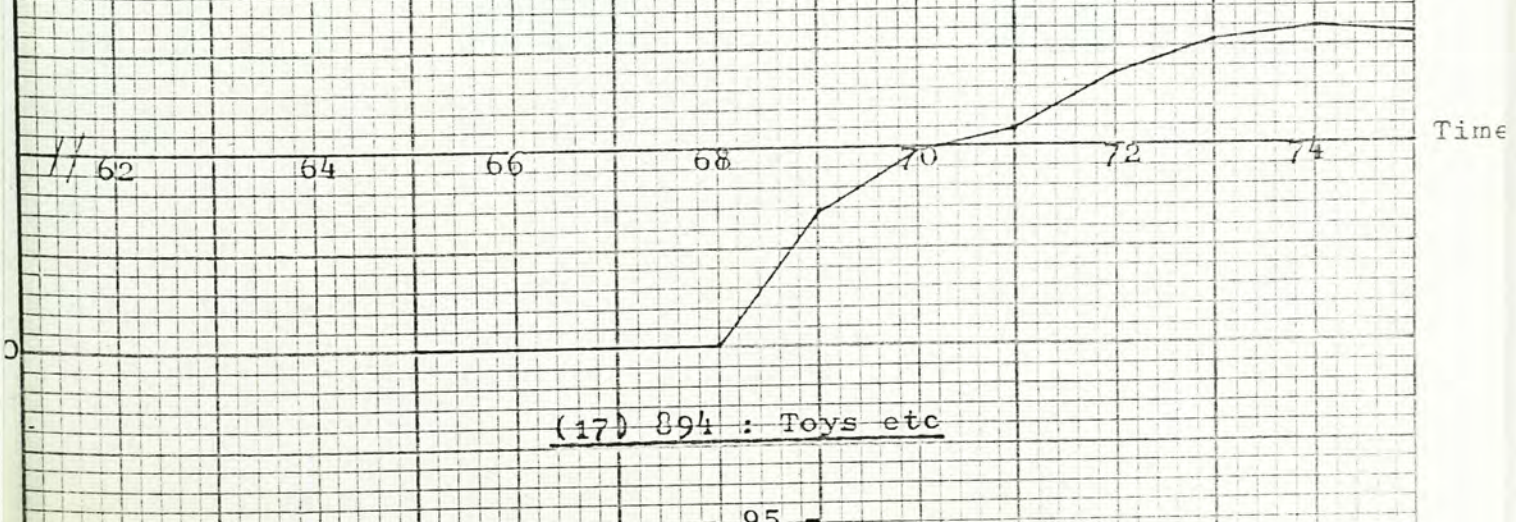
Figure 4
(cont.)



(15) 842 : Fur clothes etc

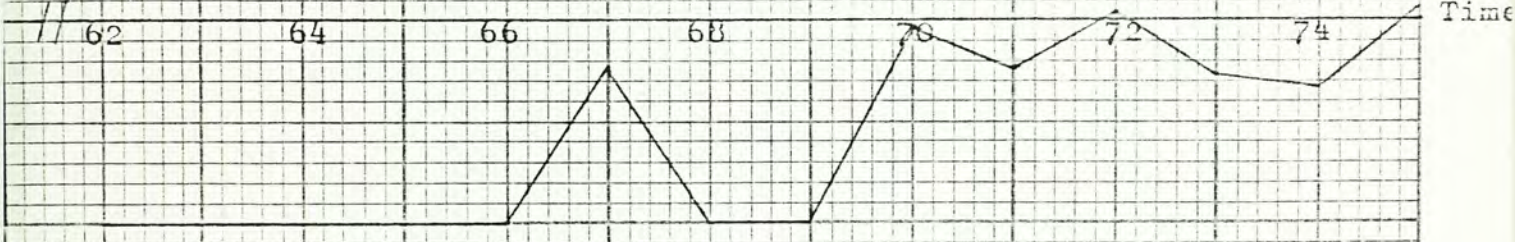


(16) 893 : Plastic mfs nes

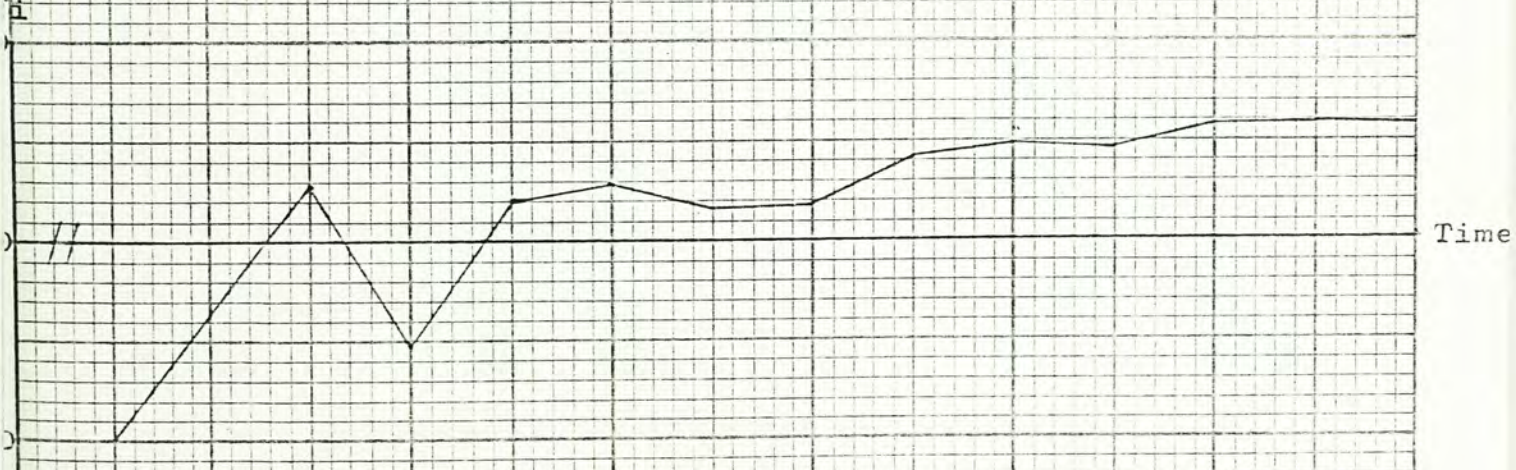


(17) 894 : Toys etc

Figure 4
(cont.)



(18) 895 : Stationery etc



(19) 899 : Mfd goods nes

By inspecting these figures, at first sight, one would probably appreciate one of the advantages in using the inter-industry trade level index method to conduct trade flows analyses. If we use only the numerical values, no comparable figures can be presented.

The timing of occurrence of various changes in trade position from the net importer to that of a net exporter are clearly shown by these figures. The results are exactly what we have just described in the former paragraph. Anyhow, the figures provided us with more detailed informations about the speed of each change and its style of change. Changes in commodities 553, 665, 679, 841 and 842 were quite speedy. They required more or less one to two years only. On the other hand, moderate speed changes were found in commodities 633, 661, 697 and 831. These changes have taken place in less than four years' time. Lastly, changes in commodities 571, 652, 656, 666, 671, 725, 893, 894, 895 and 899 have taken place rather slowly. Five or more than five years were required for their changes.

Concerning the styles of these changes, regular patterns have found in commodities 553, 652, 656, 661, 665, 697, 725, 893 and 894. Less regular patterns of changes were those in commodities 571, 633, 679, 841 and 842. And, irregular patterns of change were found in commodities 666, 671, 831, 895 and 899.

As a whole, the speed and the style of a change in trade position of a certain product cycle commodity depend much on the time required to learn and to take hold of the relevant technology in producing it. If the technology in producing a certain commodity can easily be taken hold of, the corresponding domestic productions will be started earlier. And, the product's change in trade position will be more speedy. In this regard, the textiles industry, the clothes and garments industry are good examples.

At the same time, the market demand also plays an important position. For a widely accepted commodity with steady consumption demands, it's change in trade position will be speedy and regular. Commodities 553 (perfume, cosmetics), 652 (cotton fabrics), 656 (glass-wares), 697 (metallic housewares), 725 (domestic electric equipments), 893 (plastic mfs. nes) and 894 (toys etc.) are all such goods. Of course, the stimulus of government policy also plays an active role.

Other than those product cycle trade commodities, from Table 4.3, a number of industries are also detected to have exhibited the trend of similar changes in bilateral trade position. However, these changes have not yet succeeded in altering the net importer position. The industries concerned are listed in Table 4.5 on the next page.

Table 4.5

Cyclical Trend Observed Commodities

SITC Code	Year 1962	1970	1975
512	-100.0	- 94.1	-88.2
513	-100.0	-100.0	-93.1
514	-100.0	-100.0	-93.0
531	-100.0	-100.0	-90.8
541	-100.0	- 93.0	-30.0
599	-100.0	-100.0	-86.0
621	---	-100.0	-88.1
629	-100.0	-100.0	-51.2
641	-100.0	-100.0	-88.2
642	-100.0	-100.0	-42.1
653	-100.0	- 89.4	-77.8
654	---	-100.0	-47.9
662	-100.0	- 70.5	-68.9
663	-100.0	- 76.7	-68.4
664	---	- 87.1	-65.9
682	-100.0	- 84.9	-85.9
683	---	-100.0	-94.0
685	---	-100.0	-57.1
694	---	-100.0	-92.0
695	-100.0	-100.0	-91.5
696	---	-100.0	-90.8
698	-100.0	- 87.4	-71.5
711	-100.0	- 98.1	-93.8
714	-100.0	- 43.8	-34.6
715	-100.0	- 95.3	-91.5
722	-100.0	- 82.3	-75.1
723	-100.0	-100.0	-55.9
724	-100.0	- 87.0	-53.3
729	-100.0	- 66.8	-53.9
731	-100.0	-100.0	-86.1
733	-100.0	-100.0	-89.4
861	-100.0	- 84.1	-50.9
863	-100.0	- 31.8	-62.4
864	-100.0	- 53.9	-57.7
891	-100.0	-100.0	-77.5
892	-100.0	- 67.2	- 2.0
$\bar{A}_{i(36\ items)}$	-100.0	- 85.1	-69.9

Source : Same as Table 4.3

These 36 items were all net imports of Taiwan in 1962. After that, their production and exportation have been developed in Taiwan and the declining of their corresponding trade level indices were apparent. They follow our postulated change from -100.0, to -b (where b is a value of A_i which is less than 100).

Generally, these are commodities that require more inputs of capital and/or technology for their productions than those commodities listed in Table 4.4 such as chemicals (items 512, 513, 514 and 599), mechanical tools (items 694, 695 and 696), machineries (items 711, 714, 715, 722, 723, 724 and 729), vehicles (items 731 and 733), instruments (item 861) etc. They are usually not standardized products, rather, they are mainly mature products or even newly mature products. Probably, they will be prosperous exportables in the coming future since Taiwan can gradually acquire competitiveness in productions and export trades, even in a highly competitive foreign market like Japan.

4.3 Considerations on our Findings

Upon the above findings, evidence of product cycle trade has been obtained in our bilateral commodity flows investigations. In terms of our case, such an experience can further be interpreted as: Following Taiwan's pace of industrialization, as well as the opportunities provided

by the more developed countries (e.g. Japan) owing to their changes in industrial structure, various industries in Taiwan which produce mainly those standardized or mature products have successfully expanded their production and export activities. Starting from the import-substitution process in the early sixties, after a period of time, due to the domestic accumulation of capital and technical know-how, foreign investments, and benefited from a prosperous world economic surroundings, an export-oriented economic growth has led to the rapid change of Taiwan's production structure in the late sixties. More recently, newly mature products which require more capital and/or technology inputs have also become Taiwan's important exportables. All in all, such a process can be revealed in her trade flows records, and in the pattern of her product cycle trade experience in particular.

Since our detailed investigations on commodity flows started only from 1962, one may worry that other product cycle trade experiences might exist during 1954 to 1961 where the traded commodities were not classified under the SITC system but might be in more primitive versions[4]. However, as we have mentioned before, the exportables of Taiwan in those early days were only primary goods and their

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[4] The importance of clarifying this point was due to Professor Mo-Huan Hsing

finished products. These commodities, according to the product cycle model, are referred to as Ricardo Goods. They are not product cycle goods which we purport to include. Moreover, from Table 4.3, we discovered that even in 1962, all items within the SITC 5 to 8 sections were imported from Japan ($\overline{A}_{i(5-8)} = -99.7$), the exports of even the most primitive-version manufactures can only take place later. Therefore, we may conclude that trade data between 1954 and 1961 can be omitted without sacrificing any significant evidence.

CHAPTER V

MORE DETAILED INVESTIGATIONS OF THE PRODUCT CYCLE COMMODITIES

5.1 An Intra-Industry Trade Analysis of the Product Cycle Commodities

After inspecting the inter-industry trade flows, now, in order to have the more detailed contents of the relevant product cycle commodities, we turn to another important aspect of trade flows analysis, namely, the intra-industry specialization.

In conventional intra-industry trade studies, analyses were conducted mainly among countries which have a similar level of industrial development[1]. Their results have led to the hypothesis that, over time, trade development through product diversification would lead to more intra-industry specialization than inter-industry specialization. The level of intra-industry trade is expected to be higher and higher. Eventually, international specialization would stabilize at a level corresponding to a country's natural resources and factor endowment position. At this stage, the level of intra-industry trade between countries (of similar level of industrial development) would be the highest.

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[1] For instance, the Common Market countries.

In terms of the conventional intra-industry trade level index (B_i)[2], Balassa suggested that[3], over time, B_i tends to move towards 100, i.e., the level of intra-industry trade becomes the highest[4].

In our study, the trade partners, Taiwan and Japan, are at different level of industrial development. Therefore, the arguments concerning their intra-industry trade flows would be different from the conventional arguments. According to the Product Cycle Model, at the beginning, due to import-substitution and export-expansion of a developing country, the intra-industry trade flows of those mature and/or standardized commodities will increase. Later, as the industrial country concerned begin to lose comparative advantage in such commodities, she will gradually contract the production of, or even the withdrawal from the production of, these commodities. So, the level of intra-industry will decline. However, the extent of the initial increase and the eventual decline in the intra-industry trade level of these products depend chiefly on the nature of these commodities.

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[2] $B_i = \frac{X + M - |X - M|}{X + M}$. For a discussion on this definition, please see Chapter Three above.

[3] B. Balassa, "Tariff Reduction & Trade in Manufactures among the Industrial Countries", American Economic Review June 1966, p. 472.

[4] $B_i = 0$, if $X = 0$ or $M = 0$;
$B_i = 100$, if $X = M$.

For a technology-intensive and/or capital-intensive product[5], over time, there will only be a little increase in intra-industry trade level. This is because the industrial country concerned still possesses competitiveness in producing such a product. But, for a moderately capital-intensive product, over time, there will be a more increase in the intra-industry trade level. This is becuase the comparative advantage in producing some substitutes has shifted to the developing country. Concerning a mature or standardized product, owing to the possession of competitiveness by the developing country, there will be a significant increase in the intra-industry trade level. But over time, due to the contraction or the withdrawal from the production of such product in the industrial country, there will be an eventual decline of the intra-industry trade level. However, the direction of trade flows has been reversed.

In terms of our modified intra-industry trade level index (B_i) suggested in Chapter Three, we have:

B_i = 200, if X = 0 (i.e., a net importer position);

= 100, if X = M (here the level of intra-industry trade is the highest);

= 0, if M = 0 (i.e., a net exporter position).

Accordingly, for a technology-intensive and/or capital-intensive product, over time, B_i will not be significantly different from its initial position, which is usually close

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[5] The product here refers to one which contains a spectrum of sub-products, or, close substitutes.

to 200. For a moderately capital-intensive product, over time, the corresponding B_i will come closer to 100, whereas for a more labot-intensive (mature or standardized) product, B_i will continue to decline towards 0.

Upon these arguments, our investigation will be continued on commodities which are outputs of the same industry of close but imperfect substitutes. Since the 6-digit data are scarcely available, we can only use the 4-digit or 5-digit break-downs in the following analyses. For convenience sake, descriptions of the sub-items of the product cycle commodities are listed before Table 5.1.

4- to 5-digit Level SITC Items

55302 Toilet powder, including eau de Cologue & the like
03 Pomade & perfumed hair oil, lipsticks & rouges, hair creams, foundation creams, creams in liquid form; toilet preparations of oil, fat or wax, nes.
04 Shaving preparations, excluding those of oil, fat or wax; shampoos in liquid or paste form; perfumery & toilet preparations in liquid or paste form, nes.
06 shampoos
07 Incenses, excluding mosquito-sticks; perfumery & toilet preparatios.
5711 Prepared explosives, black powder etc.
2 Fuses, primers, detonators, safety fuses etc.
3 Pyrotechnic products, amorces, railway fog signals & other similar pyrotechnic articles
4 Hunting & sporting ammunition
63301 Articles of natural cork
02 Other cork manfs.
6521 Grey woven cotton fabric
2 Woven cotton blchd., etc.
3 Other cotton fabrics, not including narrow fabrics
6561 Bags & sacks of textile materials
2 Tarpaulines, tents, awnings, sails, and other madeup canvas goods
6 Blankets, travelling rugs & coverlets
9 Madeup articles of textiles materials, nes.
6611 Lime
2 cement
3 Building & monumental stone, worked
8 Building materials of asbestos-cement & fibre-cement & of unfired non-metallic minerals, nes.
6651 Carboys, bottles, jars, flasks & similar containers, stappers & other closures of glass
2 Glass tablewares & other articles for household, hotel & restaurant use
8 Articles made of glass etc.
6664 Procelain or China householdware
5 Householdwares of other ceramic materials
6 Ornaments, & articles of personal adornment, & furnishing goods of procelain, China or other ceramic materials, nes.
6712 Pig iron
3 Iron & steel powder, shot & sponge
4 ferro-manganese
5 Other ferro-alloys
6791 Iron castings in the rough state
2 Steel castings in the rough state
3 Iron & steel forgings in the rough state
6971 Domestic stoves, boilers, cookers, ovens space, heaters, nes.
2 Domestic utensils of base metals
9 Other domestic equip. of base metals
72501 Domestic elec. refrigerators & parts of them
02 Domestic washing machines & parts
03 Vaccum cleaners, floor polishers, juicers & juice mixers, electric fans, & electro-mechanical domestic appliances etc.

(cont.)

72504 Electro-mechanical domestic apliances, with self-contained elecric motor, battery drivrn, nes.
05 Parts of electro-mechanical domestic appliances, nes.
06 Electric shavers, hair clippers & their parts
07 Electric water heaters, soil heating apparatus & elctric hair dreasing appliances
08 Electro smoothing irons, rice cookers, toasters pots, microwave oven clothes dryer, electric thermic, domestic appliances, nes.
09 Electric heating resistors & their parts
83101 Handbags, of leather or of composition leather
02 Leather cases for cameras, binoculars, monoculars etc; purses, key cases, pass cases or similar articles; travel goods, golf-bags, brief-cases & similar articles of leather or of composition leather nes.
03 Travel goods, hand-bags, brief-cases & similar articles, of vulcanized fibre or of paperboard
04 Purses, cigarette cases, pass cases & similar articles, of artificial plastic sheeting
05 Wallets, purse & similar articles of textile fabrics; travel goods, golf-bags, tool-cases & similar articles, of rubberized textile fabrics
8410 Outer garments, of textile fabrics, not knitted or crocheted
1 Under garments, of textile fabrics, not knitted or crocheted
2 Clothing accessories of textile fabrics, not knitted or crocheted
3 Apparel & clothing accessories of leather
4 Clothing & accessories, knitted or crocheted
5 Headgear
6 Apparel & clothing accessories includung gloves of rubber
84201 Apparel & clothing accessories of furskins
02 Articles of furskins, nes.
89301 Tableware & kitchenware of artificial plastic materials
02 Articles of synthetic resins, nes.
03 Raincoats, gloves of vinyl chloride resing; apparel & clothing accessories of artificial plastic materials, nes.
04 Sanitory & plumbing fixtures & fittings of artificial plastic materials
05 Office & stationary supplies of artificial plastic materials
09 Articles of artificial plastic materials, nes.
8941 Baby & invalid carriages (not motorized nor otherwise mechanically propelled)
2 Toys, indoor games etc.
3 Non-military arms
4 Outdoor sports goods etc.
5 Amusements etc., for fairs
8951 Base metal office supplies
2 Pens, pencils, founten pens
9 Other office & stationary supplies
8991 Articles & manf. of carving & moulding material
2 Articles of plaiting materials, nes., brooms, brushes, feather dusters
3 Candles, matches, combustible products, smokers requistes
4 Umbrellas, parasols, walking sticks & similar articles
5 Small-wares & toilet articles, nes.
6 Orthopaedic appliances, hearing aids, artificial parts of the body
9 Other manf. articles, nes.

Table 5.1

An Intra-Industry Trade Level Index (B_i) of the Product Cycle Commodities in selected periods : 1962/63, 1968/69, 1974/75.

(Unit = US$1,000 for X_i and M_i)

4-5 digit SITC items	1962/63			1968/69			1974/75		
	X_i	M_i	B_i	X_i	M_i	B_i	X_i	M_i	B_i
55302	---	---	---	---	---	---	---	1	200.0
03	---	---	---	---	---	---	---	12	200.0
04	---	---	---	---	---	---	---	9	200.0
06	---	---	---	---	---	---	---	11	200.0
07	---	---	---	---	---	---	168	18	19.4
$\bar{B}_{553}$									54.8
5711	---	362	200.0	---			---	---	---
2	---	} 36	200.0	---	} 96	200.0	17	5	45.5
3	---			---			1,244	20	3.2
4	---	---	---	---	---	---	---	9	200.0
$\bar{B}_{571}$									5.3
63301	---	---	---	---	---	---	---	9	200.0
02	---	---	---	---	---	---	5	17	154.4
$\bar{B}_{633}$									167.7
6521	---	23	200.0	2,573	13	1.0	7,845	506	12.1
2	---	231	200.0	194	634	153.1	806	659	90.0
3	---	---	---	---	---	---	---	1,997	200.0
$\bar{B}_{652}$									53.5
6561	---	---	---	---	---	---	3,086	39	2.5
2	---	---	---	---	---	---	28	9	48.6
6	---	---	---	---	---	---	10	55	169.2
9	---	---	---	---	---	---	4,427	156	6.8
$\bar{B}_{656}$									6.6
6611	---	---	---	---	72	200.0	---	5	200.0
2	---	---	---	---			---	575	200.0
3	---	---	---	---	} 47	200.0	3,899	3	0.2
8	---	---	---	---			14	54	158.8
$\bar{B}_{661}$									28.0
6651	---	---	---	---	---	---	78	1	2.5
2	---	---	---	---	---	---	603	32	10.1
8	---	---	---	---	---	---	305	266	93.2
$\bar{B}_{665}$									46.5
6664	---			---			18	253	186.7
5	---	} 80	200.0	---	} 376	200.0	18	12	80.0
6	---			---			152	8	10.0
$\bar{B}_{666}$									118.4

Table 5.1 (cont.)

(Unit=US$1,000 for X_i and M_i)

~~4-5~~ digit SITC items	1962/63 X_i	1962/63 M_i	1962/63 B_i	1968/69 X_i	1968/69 M_i	1968/69 B_i	1974/75 X_i	1974/75 M_i	1974/75 B_i
6712	---	---	---	---	---	---	---	1,422	200.0
3	---	---	---	---	71	200.0	---	370	200.0
4	---	---	---	---			321	258	89.1
5	---	---	---	---	53	200.0	7,009	276	7.6
$\bar{B}_{671}$									48.2
6791	---	---	---	---	---	---	274	103	54.6
2	---	---	---	---	---	---	104	14	23.7
3	---	---	---	---	---	---	6	142	191.9
$\bar{B}_{679}$									80.6
6971	---	---	---	---	72	200.0	515	224	60.6
2	---	---	---	---	6	200.0	1,094	124	20.4
9	---	---	---	---			82	1	2.4
$\bar{B}_{697}$									34.2
72501	---	405	200.0	---	460	200.0	662	957	118.2
02	---			---	---	---	1	575	199.7
03	---			---	65	200.0	1,538	59	7.4
04	---			---	---	---	23	9	56.2
05	---	106	200.0	---	77	200.0	1	75	197.4
06	---			---	---	---	3	105	194.4
07	---			---	---	---	3	23	176.9
08	---			---	---	---	45	223	166.4
09	---			---	---	---	66	194	149.2
$\bar{B}_{725}$									97.3
83101	---	---	---	---			1	4	160.0
02	---	---	---	---			211	48	37.1
03	---	---	---	---	52	200.0	2,169	1	0.1
04	---	---	---	---			---	177	200.0
05	---	---	---	---			---	10	200.0
$\bar{B}_{831}$									18.3
8410	---	---	---	---	---	---	---	248	200.0
1	---	---	---	313	---	0	41.503	13	0.1
2	---	---	---	---	---	---	3,734	145	7.5
3	---	---	---	58	---	0	2,009	34	3.3
4	---	---	---	1,083	---	0	54,981	171	0.6
5	---	---	---	---	---	---	626	5	1.6
6	---	---	---	---	---	---	21	51	141.7
$\bar{B}_{841}$									1.3

Table 5.1 (cont.)

(Unit=US$1,000 for X_i and M_i)

4-5 digit SITC items	1962/63 X_i	1962/63 M_i	1962/63 B_i	1968/69 X_i	1968/69 M_i	1968/69 B_i	1974/75 X_i	1974/75 M_i	1974/75 B_i
84201	---	---	---	---	---	---	40	42	102.4
02	---	---	---	---	---	---	21	6	44.4
$\bar{B}_{842}$									88.1
89301	---	---	---				27	30	105.3
02	---	---	---				5,454	---	0
03	---	---	---				---	160	200.0
04	---	---	---	72	467	173.3	---	20	200.0
05	---	---	---				---	38	200.0
09	---	---	---				77	2,104	192.9
$\bar{B}_{893}$									59.5
8941	---	---	---	---	---	---	17	1	11.4
2	---	---	---	59	194	153.4	6,265	1,274	33.8
3	---	---	---	---	---	---	---	52	200.0
4	---	---	---	81	260	152.5	5,707	1,867	49.3
5	---	---	---	---	10	200.0	---	36	200.0
$\bar{B}_{894}$									42.4
8951	---			---	70	200.0	25	37	119.4
2	---	256	200.0	---	218	200.0	853	885	101.8
9	---			---	---	---	42	176	161.5
$\bar{B}_{895}$									108.8
8991	---			---			1,760	7	0.8
2	---			---			6,072	103	3.3
3	---			---			233	426	129.3
4	---	513	200.0	---	1,157	200.0	2,518	327	23.0
5	---			---			548	1,861	154.5
6	---			---			99	283	148.2
9	---			---			1,233	278	36.8
$\bar{B}_{899}$									41.7
$200 \sum_{1}^{n} M_i$ =	402,400			824,000			4,163,000		
$\sum_{1}^{n} (X_i + M_i)$ =	2,012			9,710			191,531		
$\bar{B}_{\text{all items}}$ =	200.0 (n = 9)			84.9 (n = 24)			21.7 (n = 81)		

Source : same as Table 4.3

Key : X_i – exports of Taiwan to Japan in unit of US$1,000
M_i – imports of Taiwan from Japan in unit US$1,000
" --- " – indicates no record of data

The absolute amounts (unit in US$1,000) of imports and exports are shown in Table 5.1 in order to indicate the importance of such trade flows. For instance, item 55302 has a B_i = 200.0 in the 1974/75 period, but because its corresponding amounts of exports and imports are only 0 and 1, this item is of little weight to the analyses.

By inspecting Table 5.1, first of all, the significant increase in the number of items involved (i.e., the increase in "n" from the initial 9 to that of 24 in the period 1968/69 and finally to that of 81 in period 1974/75) has revealed clearly the phenomenon of product diversification in Taiwan's trade development.

Then, concerning the overall trend, other than the intra-industry trade level index calculated for each item, we have also calculated the average intra-industry trade level index ($\overline{B}_i$)for each 3-digit group as well as that for all items in each period. The resulting $\overline{B}_i$ for all items in the three periods are 200.0, 84.9 and 21.7 respectively. Clearly, this is an experience similar to that we have postulated[6], i.e., for those more labor-intensive and standardized products, owing to the comparative advantage of the developing country, there will be a significant increase in intra-industry trade level after some time. But as time goes on, due to the contraction of or the withdrawal

[6] Discussion in text above.

from the production of these products in the industrial country, there will be an eventual decline of the intra-industry trade level. Accordingly, since our product cycle commodities are mainly labor-intensive and/or moderately capital-intensive mature and/or standardized products, such an experience is rather natural.

Now, considering the $\overline{B}_i$ of each 3-digit group, we observe that the highest intra-industry trade level industries in 1974/75 period were domestic electric equipments ($\overline{B}_{725}$ = 97.3), fur clothes etc. ($\overline{B}_{842}$ = 88.1), stationeries etc. ($\overline{B}_{895}$= 108.8)[7], pottery ($\overline{B}_{666}$ = 118.4) and casting iron & steel ($\overline{B}_{679}$ = 80.6). This indicates that Taiwan has managed to acquire only part of the competitiveness in the production and exportation of th se commodities, and still has to import some items within each group.

On the contrary, the intra-industry trade level of some groups of commodities have declined towards 0 in the 1974/75 period. They are: clothes not fur ($\overline{B}_{841}$ = 1.3), explosives etc. ($\overline{B}_{571}$ = 5.3), madeup textiles ($\overline{B}_{656}$ = 6.6) and handbags ($\overline{B}_{831}$ = 18.3). This indicates that Japan has reduced exports of these labor-intensive standardized pro-

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[7] Since we employ here average data in period 1974/75, the $\overline{B}_i$ of 3-digit groups like 633, 666, 895 are not entirely consistent with the corresponding A_i in Table 4.3.

ducts, and, their "Location of production" have been almost entirely shifted to Taiwan or to other developing lands.

On the other hand, the intra-industry trade level of the remaining groups of commodities were found to scattered within the range of 30 to 50. This shows that there has been a change in the direction of trade flows between Taiwan and Japan concerning these commodities.

5.2 The Contents of the Relevant Intra-Industry Trade Flows

In relation to the Product Cycle Model, a suggestion given by Louis T. Wells Jr. concerning intra-industry trade was the "existence of different models (versions) of a product"[8]. That is, for manufactured products, the exportables of the developing countries are believed to be mainly those primitive versions of a certain product. At the same time, these developing countries will import from the industrial countries those sophisticated versions of that product.

This hypothesis is based mainly on the following considerations. (1) Different technological attainments among countries, (2) Different income levels among countries, and (3) New products vs mature products.

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[8] Louis T. Wells, Jr., The Product Life Cycle and International Trade, Havard University Press, 1972, p.17.

Concerning the first consideration, it is found that, in production, the existence of "technological gap" does give rise to product differentiation and narrow specialization. Producers in a multi-product industry have technological advantages in some items relative to producers in other countries. At the same time, they get technological disadvantages in other items of the same industry.

About the second point, due to different levels of income among countries, consumers with higher incomes would incline to use those high-quality, high-priced "versions", On the other hand, consumers with lower incomes would take up the low-quality, low-priced "versions". Since a developing country has the majority of her people earning lower income, it is more beneficial for them to specialize in the production of the primitive or common version products, supplying her domestic market and then exports the rest to meet the demands of the lower income consumers in other countries. Alternatviely, an industrial country will produce and export those sophisticated version products.

The third point is simply a Product Cycle Model's explanation. The industrial countries are the location of production for newly developed technology-intensive products and capital-intensive newly mature products. On the other hand, the developing countries are more ideal location of production for those mature and/or standardized labor-intensive

and/or moderately capital-intensive products.

To verify these arguments, we have to inspect carefully the detailed contents of the 4-5 digit items in Table 5.1.

Referring to the detailed descriptions of items, in industry 652 (cotton fabrics), Taiwan exported items 6521, 6522 which are grey cotton fabrics and woven cotton blchd. etc; Japan exported item 6523, cotton fabrics of better qualities.

In industry 725 (domestic electric equipments), Taiwan exported items 72501, 72503 and 72504 which are ordinary domestic electric appliances such as refrigerator, electric fan, floor-polisher etc. On the other hand, Japan exported items 72501, 72502, 72505, 72506, 72508 and 72509 which are comparatively modern domestic electric appliances such as washing machine, microwave oven, clothes dryer and heating resistors etc.

Concerning industry 831 (handbags), the main contents of products in this industry are handbags, brief-cases and similar articles. However, these products can be produced by different materials. Namely, Taiwan exported those made of leather or paper-board (83102, 83103), and imported those made of artificial plastic sheetings or textile fabrics (83104, 83105) from Japan.

For garments, i.e., industry 841, Taiwan's exportables are mainly the low-priced items such as 8411 (under garments,

of textile fabrics, not knitted or crocheted), 8413 (apparel & clothing accessories of leather), 8414 (clothing & accessories, knitted or crocheted) and 8415 (headgear); and, Japan's exported items 8410 and 8416 are of outer garments and fashions etc.

In industry 894 (toys etc.), Taiwan is competitive in exporting toys and simple indoor-games (8941, 8942); while Japan's exportables are those amusements for fairs (8943) and non-military arms (8945).

Besides these, Taiwan's other exportables are noted to be typical standardized products, namely, 6561, 6569 (bags & sacks or other madeup articles of coarse-grained textile materials), 6651, 6652 (common glasswares such as bottles & jars etc.), 6971, 6972, 6979 (domestic utensils made of base metals), 89302 (articles of synthetic resins etc.) as well as 8994 (umbrellas & sticks) etc.

As a whole, since Taiwan has not yet been well equipped with capital and technology at the present stage of industrial development, she can only manage to do well in the import-substitution and export-expansion of those common version products; whilst the supplies of higher quality products still rely much on imports. And, that is why her intra-industry trade level (with Japan) would not become zero afterall.

5.3 A Supplementary Analysis - the "Revealed Comparative Advantage" of the relevant commodities

In order that our analyses may eventually be interpreted within the Law of Comparative Advantage, after the intra-industry specialization in trade flows have been considered, there calls for the inspection of the comparative advantage position of the relevant commodities. As proposed by the Product Cycle Theory, developing countries are competitive in producing and exporting mature and/or standardized products. Since the nature of our product cycle commodities have been noted to be mature or standardized, it remains only to display their particulars in comparative advantage.

Upon trade statistical data similar to that we have employed, Balassa has developed a method in revealing the comparative advantage of a certain commodity in trade. This is known as the "Revealed Comparative Advantage (RCA)" approach[9], Under the assumption of uniformity in tastes and a uniform incidence of duties in every industry within each country, export-import ratios would reflect relative competitiveness of the commodities in trade. According to Balassa[10], the "revealed" comparative advantage can be

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[9] B. Balassa, "Trade Liberalization &'Revealed' Comparative Advantage", Manchester School of Economics & Social Studies, May 1965, pp. 99-117.

[10] Ibid., p. 103.

indicated by the trade performance of individual countries with regard to manufactured products, in the sense that the commodity pattern of trade reflects relative costs as well as differences in non-price factors[11].

Originally, Balassa's formula was designed to reveal the comparative advantages in exportables of two or more than two countries in the world market (actually, the world market was referred only to ten industrial countries as a group in Balassa's paper). Balassa suggested:

$$\phi_i^h = X_i^h / X_{ij}^h \qquad (1)$$

where, x_i^h : country-i's exports of commodity-h to the world,

x_{ij}^h : country-i and country-j's total exports of commodity-h to the world,

ϕ_i^h : the "relative share"[12] of exports concerned;

and,

$$\phi^m = X_i^m / X_{ij}^m \qquad (2)$$

where, X_i^m : country-i's exports of all manufactured goods (i.e., the SITC 5-8 sections[13]) to the world,

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11 The non-price factors are: technology, skilled labor, economies of scale etc.

12 The expression "relative share" refers to the ratio of the share of country-i in the exports of commodity-h to the share of country-i in the export of all manufactures.

13 Such a selection was suggested by Balassa in his "Trade Liberalization & 'Revealed' Comparative Advantage", Manchester School of Economics & Social Studies, May, 1965, p.104.

x_{ij}^{m} : country-i and country-j's total exports of all manufactured goods to the world,

ϕ^{m} : the "relative share" of exports concerned;

then, the RCA Index, I_i^h, of country-i in comparison with country-j in the world market for commodity-h is:

$$I_i^h = \phi_i^h / \phi^m$$

However, concerning a bilateral trade case, the modified formula employed by S-k Liao[14] is more relevant. Liao suggested:

$$\theta_{i-j}^h = X_{i-j}^h / M_j^h \qquad (4)$$

where, X_{i-j}^h : country-i's exports of commodity-h to country-j,

M_j^h : country-j's total imports of commodity-h,

θ_{i-j}^h : the "relative share" of country-i's exports of commodity-h in country-j;

and,

$$\theta_{i-j}^t = X_{i-j}^t / M_j^t \qquad (5)$$

where, X_{i-j}^t : country-i's exports of all commodities (i.e., SITC 0-9 sections all together) to country-j,

M_j^t : country-j's total imports of all commodities,

θ_{i-j}^t : the "relative share" of country-i's exports of all commodities in country-j;

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[14] S-k Liao "An Analysis of Export Growth & Trade Flows of H.K.", unpublished Master Thesis, C.U.H.K., 1977, pp. 56-62.

then, the corresponding RCA Index of country-i's exports of commodity-h in the market of country-j is:

$$I^h_{i-j} = \theta^h_{i-j} / \theta^t_{i-j} \qquad (6)$$

In the light of concentrating on manufactures only, formula (5) is revised as :

$$\theta^m_{i-j} = X^m_{i-j} / M^m_j \qquad (7)$$

where, X^m_{i-j} : country-i's exports of all manufactured goods[15] to country-j

M^m_j : country-j's total imports of all manufactured goods,

θ^m_{i-j} : the "relative share" of country-i's exports of all manufactured goods to country-j;

using formula (4), our RCA Index of country-i's exports of commodity-h in the market of country-j will be:

$$I^h_{i-j} = \theta^h_{i-j} / \theta^m_{i-j} \qquad (8)$$

For better examination, this index is multiplied by 100 [16], giving:

$$I^h_{i-j} = \frac{X^h_{i-j}}{M^h_j} \circ \frac{M^m_j}{X^m_{i-j}} \circ 100 \qquad (9)$$

This index may take up any non-negative values. It equals to zero if the two countries do not trade with each other, and approaches infinity as the value of country-j's

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15 Balassa's using SITC 5-8 sections as the denominator in calculating θ^m_{i-j} is more consistent with the Product Cycle Approach. See also note 13.

16 S-k Liao, " An Analysis of Export Growth & Trade Flows of Hong Kong ", unpublished Master Thesis, C.U.H.K., 1977, p. 60.

world imports of all manufactured goods approaches zero.

For a certain exportable of a certain country, an index of 110 will mean that this country's share in this commodity's export is 10% higher than its share in the total exports of all manufactured goods in the market of another country[17]. Thus, a commodity is considered to be better-than-average in its export performance in a certain country if its RCA index is greater than 100. On the other hand, it is weaker-than-average if its RCA index is below 100[18].

In short, we have:

$$0 \leq I^{h}_{i-j} \leq \infty$$

and $I^{h}_{i-j} < 100$: weaker-than-average performance,

> 100: better-than-average performance.

Upon this criteria and by applying formula (9), we are going to produce and inspect the "revealed" comparative advantages of the products concerned.

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17 B. Balassa, " Trade Liberalization & " Revealed " Comparative Advantage ", Manchester School of Economics & Social Studies, May 1965, p. 105.

18 S-k Liao, " An Analysis of Export Growth & Trade Flows of Hong Kong ", unpublished Master Thesis, C.U.H.K., 1977, p. 60.

Table 5.2 and Table 5.3 that follow present our trade datas as well as the calculated RCA indices according to formula (8) above in the 1974/75 period, where

X^h_{i-j} is Taiwan's exports of commodity-h to Japan,

M^h_j is Japan's total imports of commodity-h,

θ^h_{i-j} is the "relative share" of Taiwan's exports of commodity-h in Japan,

and X^m_{i-j} (i.e., Taiwan's exports of all manufactured goods to Japan) = US$ 436,165,000

M^m_{i-j} (Japan's total imports of all manufactured goods) = US$ 13,013,353,000

so that $\theta^m_{i-j} = X^m_{i-j} / M^m_j = 0.0335.$

Notably, this is the common denominator in calculating all the RCA indices in Tables 5.2 and 5.3, since we have $I^h_{i-j} = \theta^h_{i-j} / \theta^m_{i-j}$ according to formula(8) above.

In addition, the average RCA index of a certain set of country-i's exportables in the market of country-j will be,

$$\bar{I}_{i-j} = \frac{\sum_1^n X_{i-j}}{\sum_1^n M_j} \cdot \frac{M^m_j}{X^m_{i-j}} \cdot 100 \qquad (10)$$

By using these datas and formulae, we obtained Table 5.2 as:

Table 5.2

The RCA Index of the Product Cycle Commodities (19 items) in the 1974/75 period

SITC Code	X^h_{i-j} (US$1,000)	M^h_j (US$1,000)	θ^h_{i-j} (ratio)	I^h_{i-j} (index)
553	168	29,079	0.0058	17.3
571	1,261	8,638	0.1460	435.8
633	5	1,754	0.0029	8.7
652	8,651	114,809	0.0754	225.1
656	7,551	69,166	0.1092	326.0
661	3,913	25,406	0.1540	459.7
665	986	22,033	0.0448	133.7
666	188	12,842	0.0146	43.6
671	7,329	222,962	0.0329	98.2
679	382	4,024	0.0949	283.3
697	1,691	24,888	0.0679	202.7
725	2,342	62,778	0.0373	111.3
831	2,380	42,776	0.0556	166.0
841	102,873	651,659	0.1579	471.3
842	61	30,897	0.0020	6.0
893	5,558	46,109	0.1025	359.7
894	11,988	184,568	0.0650	194.0
895	919	27,900	0.0329	98.2
899	12,461	123,114	0.1012	302.1
Total	170,707	1,705,402		
$\bar{\theta}_{i-j}$			0.1001	
$\bar{I}_{i-j}$				298.8

Source : Japan Exports and Imports, Dec.1974, Dec.1975.

Results displayed in Table 5.2 support the hypothesis that the developing countries have comparative advantage in those standardized goods which have experienced product life cycles. Out of the nineteen industries, fifteen are found to perform better-than-average (again, even in a highly competitive market like Japan). In descending order, they are: clothes (471.3), lime & cement (459.7), explosives (435.8), plastic manufactures (359.7), textiles (326.0), miscellaneous manufactured goods (302.1), casting iron & steel (283.3), cotton fabrics(225.1), metallic housewares (202.7), toys (194.0), handbags (166.0), glasswares (133.7), domestic electric appliances (111.3), pig iron (almost 100) and stationary products (almost 100).

For the remaining four industries in Table 5.2, although they were found to exhibit positive inter-industry trade level indices[19], their respective performance in trade competition in the Japanese market are weaker-than-average. Namely, their RCA positions are: fur clothes etc. (6.0), perfume cosmetic (17.3), cork manufactures (8.7) and pottery (43.6). This may well indicate that although Taiwan might have comparative advantage with respect to an industrial country like Japan (indicated by the direction of bilateral trade flows), they are less competitive to other rivals in the Japanese market (indicated by the positions of their RCA indices).

As a comparison to the above findings, we produce the

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[19] Referring to Table 4.4, the inter-industry trade level index (A_i) of industries 842, 633, 553 and 666 were 46.7, 100.0, 55.4 and 14.2 respectively.

RCA indices of those commodities which have also shown some cyclical trend[20].

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20 As listed in Table 4.5 above.

The indices whow that some industries in this group have also perfomed better-than-average in trade competitions in the Japanese market. Namely, they are: elec. distrib. mach. (423.9), telecom. equip. (375.9), road veh. (189.4), metal mfs nes (171.5), elec. mach. nes (153.9) as well as rubber mfs nes (151.2). Actually, at this stage of industrial development, although Taiwan has acquired competitiveness in the production of such products, Japan is still competitive in their productions because these are products of newly mature type as well as requiring comparatively more technology and/or capital inputs for their productions. Hence, the supplies of many items within these products are still imported from Japan, making that the direction of trade flows remains unaltered. This is indicated by their correspondingly high intra-industry trade levels as: B_{723} = 155.9 (elec. distrib. mac.), B_{724} = 189.4 (telecom. equip.), B_{733} = 189.4 (road veh. nes), B_{729} = 153.9 (elec. mach. nes), B_{698} = 171.5 (metal mfs nes), B_{629} = 151.2 (rubber mfd nes)[21].

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[21] The corresponding B_i are computed from Table 4.5.

Table 5.3

The RCA Index of the Cyclical Trend Observed Commodities (36 items) in the 1974/75 period

SITC Code	X^h_{i-j} (US$1,000)	M^h_j (US$1,000)	θ^h_{i-j} (ratio)	I^h_{i-j} (index)
512	7,694	600,728	0.0128	38.2
513	1,351	144,796	0.0093	27.9
514	287	47,941	0.0060	17.9
531	598	86,624	0.0070	20.6
541	4,751	447,808	0.0106	31.7
599	1,437	339,990	0.0042	12.6
621	360	11,709	0.0307	91.8
629	2,130	47,270	0.0451	134.5
641	2,229	149,000	0.0150	44.7
642	346	24,468	0.0142	42.2
653	8,983	393,633	0.0228	68.1
654	1,083	27,770	0.0390	116.4
662	423	10,721	0.0395	117.8
663	911	26,748	0.0341	101.7
664	676	29,561	0.0229	68.3
682	3,289	498,533	0.0066	19.7
683	179	66,569	0.0027	8.0
685	163	15,522	0.0105	31.3
694	160	16,029	0.0100	29.8
695	648	44,223	0.0147	43.7
696	39	21,477	0.0018	5.4
698	4,336	79,479	0.0546	162.9
711	1,052	285,043	0.0037	11.0
714	5,530	547,684	0.0101	30.1
715	1,394	163,762	0.0085	25.4
722	7,286	179,854	0.0405	120.9
723	3,755	26,445	0.1420	423.9
724	20,354	161,636	0.1259	375.9
729	35,033	588,508	0.0595	177.7
731	155	9,850	0.0157	47.0
733	1,162	10,728	0.1083	323.3
861	8,521	303,778	0.0281	83.7
863	16	3,724	0.0046	12.8
864	4,145	118,177	0.0351	104.7
891	3,597	97,118	0.0370	110.6
892	1,676	111,464	0.0150	44.9
Total	135,749	5,738,370		
$\bar{\theta}_{i-j}$			0.0237	
$\bar{I}_{i-j}$				70.6

Source : Same as Table 5.2

As a whole, the weighted average RCA index of this group of products is found to be 70.6. This serves to distinguish its comparative advantage position from that of the former group (where $\overline{I}_{i-j(19\ item)} = 298.8$). Anyhow, since $\overline{I}_{i-j(36\ item)} = 70.6$ is not significantly below 100, so, their weaker-than-average performances are expected to improve in the coming days as these products become more mature, and on the other hand, Taiwan's industrial structure becomes more capital and technology abundant.

From the above RCA analyses, we realize that, after the new products have passed through their life cycles and become mature or standardized products, their locations of production are determined eventually by the Law of Comparative Advantage. That is, the capital abundant countries will be competitive in producing and exporting those capital-intensive mature products whilst the labor abundant countries will be competitive in producing and exporting those labor-intensive products. In short, at this stage the product cycle goods exhibit the characteristics of Heckscher-Ohlin goods.

CHAPTER VI

THE ROLE OF FOREIGN INVESTMENT IN PRODUCT CYCLE TRADE

6.1 The Essence of Foreign Investment

In this increasingly inter-dependent world, the practice of foreign investment[1] is considered as an important external factor in promoting the rise of product cycle trade as suggested by the original article by Vernon[2].

In the past, foreign investment was generally the instrument of the advanced countries to exploit and to control the supplies of natural resources and primary goods from the developing lands (colonies). Nowadays, other than the intention to maintain such benefits, foreign investment are gradually made more and more in the industrial sector of the developing countries, because of the various restrictions

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1 In the context that follows, the term " foreign investment " is referred particularly to foreign private investment other than those foreign public investments such as foreign aid etc. which are not relevant to our analysis. Here, we are concerned with direct acquisition of ownership of business undertakings by foreign investors other than portfolio investments. These include : sole control of a business, to run business in cooporation with investors in the host country, and to establish branches, subsidiaries or even a multinational enterprise in the host country.

2 The importance of foreign investment in the context of Product Cycle Model was given in R. Vernon's original article of Product Cycle Theory, i.e., the " International Investment and International Trade in the Product Cycle ", Quarterly Journal of Economics, Vol.80, 1966, pp. 190-207.

set by the developing lands (independent countries). Thus, the acquisition of benefits can only be undertaken in a more sophisticated manner, namely, through the utilisation of the lower-cost factors of productions as well as the eventual expansion of markets.

Moreover, the increase of foreign investments in the manufacturing sector of the developing countries also results from the pressure of the changing comparative advantage position in the production of certain manufactures[3]. The lost of their competitiveness in labor-intensive and/or capital-intensive products in the world market as their domestic wages rise in step with the rise in their national income, threats from suppliers of the mature products[4], entry barriers[5] set up by foreign markets, the necessity of securing the supplies of certain materials, components or intermediate goods, as

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3 Please see Chapter Two, section (1).

4 R. Vernon, " The Location of Economic Activity ", in the Economic Analysis & Multinational Enterprises, ed. by John H. Dunning, London : Allen & Unwin, 1971, p.104.
According to Vernon, as products become mature, productions are developed in other regions. When the costs of production of these new suppliers are sufficiently low, they constitute a major threat to innovators in the industrial countries.

5 K. Kojima, " The Japanese Experience & Attitudes towards Trade Adjustment ", in The Prospect for Partnership, World Bank Publication, 1972, p. 239.
According to Kojima, barriers to new entry in international market include : (i) tariffs, (ii) import quotas, (iii) economies of scale, (iv) advanced technologies, (v) marketing and information network, vertical and horizontal integration in productions and sales etc.

well as the desire to contract those high cost industries and at the same time to promote domestic productions in more advanced industries which are in comparative advantage positions[6], all call for the establishment of new locations of productions abroad by means of foreign investment so that production costs can be cut down and markets can be secured or expanded eventually.

Theoretically, foreign investments are considered to be mutually beneficial to both the investors and recipients. From the viewpoint of the investors, their benefits are[7] :

(a) the securing of the established markets against those lower-costs producers, and/or the restrictions of trade barriers;

(b) the securing of the supplies of natural resources and raw materials;

(c) the expanding of markets after the advantages of lower-costs productions have been achieved. The new markets will be the host country (if possible) or other third countries;

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6 That is, the structural change called for by changing comparative advantage in the industrial countries as we have discussed in Chapter Three.

7 G. Clark, " An Analysis of Japanese Direct investment Overseas in Postwar Years ", The Developing Economics, No.1, 1971, pp. 58-64.

(d) the acquiring of outlets for the intermediate manufactured goods as well as the out-dated machines and equipments.

Other than these, an important function performed by foreign investment is the facilitating of the adjustments of the investors' own industrial structure. Namely, the shifting of their labor-intensive and/or capital-intensive production towards those technology-intensive and highly capital-intensive production in the investors' own countries. Here, foreign investments act as an agent of transformation and development.

Concerning a host country, benefits of receiving foreign investment are :

(a) The filling of the " savings gap "[8] and hence contributes to capital formation;

(b) Through the effect of " investment multiplier "[9], the national income of the host country will increase;

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8 M.P. Todaro, Economics for a Developing World. London : Longmans, 1977, p. 343.

9 Investment multiplier = 1/1-c, where " c " is the marginal propensity to consume. Say, if c = 0.75, the multiplier will be 4. Then, for a $1 increase in investment spending, the level of income will be raised by around $4.

(c) The increase in empoyment. This effect will be more important where population pressures result from unemployment or underemployment in the rural sector[10];

(d) The expansion of other domestic industries can thus be stimulated through the " linkage effect "[11];

(e) The training of executive personnels as well as labors in new skills. Moreover, the knowledge and know-how so acquired will be diffused in the host country.

Other than these, a valuable contribution of foerign investments is the " package "[12] therein which brings along economic development and trade expansion of the host country. Other than the physical and financial capital, the " package " contains :

(i) Technological know-hows as well as the potential of innovation and improvement;

(ii) The entrepreneurial abilities of organization and development;

(iii) The practical experiences of management and supervision;

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10 G.M. Meier, " Private Foreign Investment ", in International Investment, ed. by John H. Dunning, Penguin Modern Economic Readings, 1972, p. 418.

11 The concept of " linkage effect " was proposed by A.O. Hirschman's The Strategy of Economic Development, New Haven, Conn., Yale University Press, 1958.

12 M.P. Todaro, Economics for a Developing World. London : Longmans, 1977, p. 344.

(iv) Marketing skills and trade promotion. The foreign investors generally have more experience and broader exposure to worldwide competitive markets than the domestic firms. Henceforth, they can export relatively more than domestic firms.

As a whole, foreign investments are considered to be a vehicle for the diffusion of technologies to foster economic transformation and development. They help to locate those industries which the developing countries have comparative advantage, assist them to go over the " domestic production threshold " and then the " international competitive cost threshold "[13]. By its very nature, foreign investments entail the identification of economic opportunities, the formulation of efficient projects, and their practical implementations.

Concerning this study, we would like to examine the foreign investment situation of our " catching-up of product cycles " country - Taiwan. Initially, we shall consider the overall foreign investments in Taiwan, then, the investments made by Japan, the " creator of product cycles ", will be considered in particular. Our purpose is to show empirically

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13 K. Kojima, " The Japanese Experience & Attitudes towards Trade Adjustment ", in the Prospect for Partnership, World Bank Publication, 1972, pp.236-238.

the sensitivity of foreign investment to the comparative advantage position of Taiwan, and its relation to product cycle trade.

6.2 Foreign Investment (Overall) in Taiwan

Taiwan has taken quite a positive attitude towards the inflow of foreign investments. As a matter of fact, to her lack of natural resources as well as domestic savings, foreign investment is a helpful resort. Within the recent decades, Taiwan has done a lot to attract the inflow of foreign investments. Her efforts included the development of her infrastructures[14], the setting up of the assisting organizations[15], the opening of the Export Processing Zones[16], and the providing of clear investment targets in the light of her planned industrial development[17]. All these efforts have contributed to provide a good investment environment for the

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[14] These included: the increase of power supply, the improvements in transportation and communication, the improvement of the quality of manpower etc.

[15] These included: the forming of the Industrial Development & Investment Centre (in 1963), the admission of foreign banks to operate in Taiwan, the establishment of a stock exchange (in 1960) etc.

[16] The Export Processing Zones are in Kaohsiung, Taichung and Nantzu. The opening of these zones is considered to be a direct and effective way to attract foreign investments to the export-oriented manufacturing industries in Taiwan.

[17] Clear targets of investment can be indicated in the light of Taiwan's planned industrial development. For instance, in the late fifties and early sixties, investments on these labor-intensive "light" industries were encouraged. Then, foreign investments in those heavier industries are preferred more recently.

investors. Within our pfeiod of study, from 1952 to 1974, total foreign investment in Taiwan amounted to 924 million U.S. dollar. Its detailed contents are shown in the following table.

Table 6.1

Foreign Investments (Overall) in Taiwan, 1952 - 1974

No.	Industry	Cases	Amount (US$1,000)	%
1.	Electronic & electrical appliances	233	407,467	44.1
2.	Chemicals & chemical products	109	125,213	13.6
3.	Machinery equipments & instruments	74	104,463	11.3
4.	Basic metals & metal products	111	95,655	10.4
5.	Non-metallic mineral products	34	29,802	3.2
6.	Textiles	28	24,346	2.6
7.	Plastic & rubber products	68	18,636	2.0
8.	Garment & footwear	59	11,436	1.2
9.	Food & beverage products	36	9,464	1.0
10.	Lumber & bamboo products	23	3,674	0.4
11.	Leather & fur products	16	2,748	0.3
12.	Pulp paper & products	10	2,416	0.3
13.	Banking & insurance	14	36,139	3.9
14.	Services	20	18,466	2.0
15.	Constructions	6	9,664	1.0
16.	Transportation	4	5,647	0.6
17.	Fishery & animal husbandary	5	1,585	0.2
18.	Trade	3	1,507	0.2
19.	Mining	1	73	*
20.	Others	61	15,575	1.7
	Total	916	923,976	100.0

Source : Annual Reports, Overseas Chinese & Foreign Investment Commission, Ministry of Economic Affairs, R.O.C.

Note : A * indicates that the % is less than 0.1

From Table 6.1, 90.4% of total foreign investment in Taiwan was found to be invested in the manufacturing industries, i.e., our items 1 to 12. Hence, the view that foreign investments are made mostly in the industrial sector is supported. Also, if we try to compare the labor productivity of the listed industries, it is noted that[18] most of them are comparatively labor-intensive or moderately capital-intensive. These industries are those where lower labor costs can be realized in Taiwan.

On top of the list is the processing industry-electronic & electrical appliances. Foreign investors of this industry generally enjoy an international advantage in technology. However, their full-scale manufacturing operations are usually not located in the host country. Only the production of parts or components as well as their assembly process are left to the host country.

Following the industry of top priority are four manufacturing industries which have attracted altogether 38.5% of total investments. These include the chemicals & chemicl products industry, the machinery equipments & instrument in-

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18 By borrowing some results in Professor Hsing's book: Taiwan, Industrialization & Trade Policies, Oxford University Press, 1971, p. 302, we have the Average Labor Productivity in manufacturing industries converted into US$ at 1964 prices per person employed in 1968 as : $5,764 (petroleum & coal products), $2,232 (electronic & electrical products), $1,818 (pulp paper & products), $1,678 (chemicals & chemical products), $1,570 (food & beverage products), $1,257 (non-metallic mineral products), $1,083 (textiles), $725 (lumber & bamboo products) etc. Clearly, when the labor productivities of the listed industries are compared with that of the petroleum & coal products industry, they are revealed to be relatively labor-intensive.

dustry, the basic metals & metal products industry and the non-metallic mineral products industry. Similar to that of the electronic & electrical products industry, foreign investors of these industries also enjoy an advantage in technology.

The other manufacturing industries (i.e, items 6 to 12 in Table 6.1) are noted to be mainly those "traditional industries"[19] such as the textiles industry, the garment & footwear industry etc. These seven industries' share of total foreign investment is only 7.5%.

When foreign trade is concerned, owing to the limitations of Taiwan's domestic market, export promotion is most important for the industries set up by foreign investors. In fact, it is also Taiwan's very policy to attract foreign investments chiefly to those export-oriented manufacturing industries. In the past ten years or so, foreign investments were noted to be much contributive to the remarkable development of many industries in Taiwan. Namely, without the help of foreign investment, some capital-intensive and/or technology-intensive industries such as electronic & electrical industry, the chemical industry and the machinery industry etc. would not have been developed so successfully in production and export-expansion. Indeed, among the twelve manufacturing industries listed in Table 6.1, seven of them

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19 K. Kojima, "The Japanese Experience & Attitudes towards Trade Adjustment" in the Prospects for Partnership, World Bank Publication, 1972, p. 246.

are noted to be in the production of those "product cycle goods"[20]. They are: the electronic & electrical industry, the metal products industry, the textiles industry, the plastic products industry, the garment & footwear industry, the lumber & bamboo products industry, and the leather & fur products industry. The other five manufacturing industries, i.e., the chemical products industry, the machinery equipments & instruments industry, the non-metallic products industry, the food & beverage industry, and the pulp paper & products industry, are however noted to be involved in the production of those "cyclical trend goods"[21]. As a whole, this implies that, foreign investments are quite sensitive to the host country's comparative advantage position. And, foreign investments are made in order to complement the investors' own economic structure as the competitiveness in the production and expotation of various products are fading. This in turn, will facilitate the appropriate products in the developing countries to go into product cycle trade earlier.

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[20] For the details of "product cycle goods", please refer to Table 4.3.

[21] For the details of "cyclical trend goods", please refer to Table 4.4.

6.3 Japanese Investments in Taiwan

In order to match with our previous analysis, the foreign investments in Taiwan provided by the Japanese investors will be inspected in more detail. The following set of data is prepared in the same format as Table 6.1 to facilitate comparison. This time, only the manufacturing industries are included (i.e., items 1 to 12 in Table 6.1).

Table 6.2

Foreign Investment (Japan) in Taiwan, 1952 - 1974

No.	Industry	Case	Amount (US$1,000)	%	Rank	% to the overall foreign investment
1.	Electronic & electrical appliances	154	71,591	38.8	1	17.6
2.	Chemicals & chemical products	59	27,611	15.0	2	22.1
3.	Machinery equipments & instruments	44	18,448	10.0	4	17.7
4.	Basic metals & metal products	87	17,347	9.4	5	18.1
5.	Non-metallic mineral products	23	5,266	2.9	7	17.7
6.	Textiles	28	20,922	11.3	3	85.9
7.	Plastic & rubber products	47	9,644	5.2	6	51.7
8.	Garment & footwear	36	4,652	2.5	8	40.7
9.	Food & beverage products	16	3,652	2.0	9	38.6
10.	Lumber & bamboo products	15	2,968	1.6	10	80.8
11.	Leather & fur products	8	725	0.4	12	26.4
12.	Pulp paper & products	9	1,575	0.9	11	65.2
	Total	526	184,401	100.0		22.1

Source : Same as Table 6.1

From the above table, it is observed that the Japanese investment choices of the twelve manufacturing industries in descending order were: the electronic & electrical products industry, the chemical products industry, the textiles industry, the machinery industry, the basic-metal products industry, the plastic & rubber products industry, the non-metal products industry, the garment & footweat industry, the pulp peper & products industry, and lastly the leather & fur products industry.

As a whole, there is not much difference in the priority of investments between the overall foreign investments and Japanese investments. The top items are always the same. But, it is noted that Japanese investments are more diversified..As we can see, the first item (electronic & electrical appliances industry) attracted 37.2% of total Japanese investments; the second group of industries (items 2,3,4,and 5 as mentioned) received 35.6%;and the remaining items (i.e., 6 to 12) received 27.2%. On the other hand, the corresponding shares in these industries of the overall foreign investments were noted to be 44.1% (to item 1), 38.5% (to items 2, 3, 4 and 5) and 17.4% (to items 6 to 12) respectively[22].

The last column of Table 6.2 indicates the ratio (in

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[22] The relevant percentages were shown in Table 6.1.

percentages) of Japanese investment in each industry to the industry's overall foreign investments. This serves to reveal the importance of Japanese investment in each industry. As a whole, the Japanese share of investment in all manufacturing industries in Taiwan is 22.1%, a rather significant portion.

In addition, we found that the average share of the Japanese investments in the top five industries is only around 19%. This shows that, although Japanese investors also invest mostly in the top five items (namely, 76% of total Japanese investments are made on these five industries), their share in overall foreign investments is not outstanding. This is because other foreign investments (than Japan's) in Taiwan are rather concentrated on these five items (as we have mentioned in section 2 this chapter).

On the other hand, from item 6 to 12, the Japanese shares were far more significant. For instance, Japanese investments on the textiles industry amount to 85.9% of the corresponding overall foreign investments. Other significant shares are found in the lumber & bamboo products industry (80.8%), the pulp paper & products industry (65.2%), the plastic & rubber products industry (51.7%) and the garment & footweat industry (40.7%). This reveals that the Japanese investors are still more interested in making investments in those traditional labor-intensive industries

than other foreign investors.

Accordingly, when this set of results (Table 6.2) is compared with Table 4.3, seven of them are noted to produce those "product cycle goods". They are: the electronic & electrical appliances industry, the textiles industry, the basic-metals & metal products industry, the plastic & rubber products industry, the garments & foot-wear industry, the lumber & bamboo products indsutry, and the leather & fur products industry. In fact, the reason that we deliberately used investment data up-till only 1974 is to allow a time lag between the undertaking of investment and the export performance records, with the hope that their inter-relationship (if any) may eventually be detected.

In order to have a better understanding of the changes (if any) in the investment choice etc., we shall inspect the Japanese investments in Taiwan in two periods[23].

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[23] Since the annual records from 1953 to 1970 are not available, we can only group the data in this period into one set.

Table 6.3

Foreign Investment (Japan) in Taiwan in Two Periods

No.	Industry	1953-1970 Amount (US$1,000)	1953-1970 Col. %	1953-1970 row %	1971-1976 Amount (US$1,000)	1971-1976 Col. %	1971-1976 row %
1.	Electronic & electrical appliances	31,527	37.3	35.2	57,912	50.0	64.8
2.	Chemicals & chemical products	18,791	22.2	72.2	7,247	6.3	27.8
3.	Machinery equipments & instruments	5,118	6.1	26.7	14,067	12.1	73.3
4.	Basic metals & metal products	6,961	8.2	37.9	11,394	9.8	62.1
5.	Non-metallic mineral products	2,973	3.5	72.1	1,150	1.0	27.9
6.	Textiles	7,276	8.6	38.1	11,800	10.2	61.9
7.	Plastic & rubber products	4,919	5.8	47.2	5,498	4.7	52.8
8.	Garment & footwear	3,661	4.3	74.5	1,251	1.1	25.5
9.	Food & beverage products	1,526	1.8	38.3	2,462	2.1	61.7
10.	Lumber & bamboo products	245	0.3	9.1	2,436	2.1	90.9
11.	Leather & fur products	452	0.5	74.2	157	0.1	25.8
12.	Pulp paper & products	1,120	1.3	70.9	459	0.4	29.1
	Total	84,569	99.9	42.2	115,833	99.9	57.8

Source : Same as Table 6.1

From Table 6.3, it is observed that, in the period 1953-1970 (altogether 17 years), Japanese investments in Taiwan's manufacturing industries were altogether US$ 84,569,000. This amounted only to 42.2% of the overall Japanese investments in Taiwan by the end of 1976. However, in the second period, 1971-1976, which contains only six years, the share was 57.8%. This shows that, Japanese investments have mostly been made in the recent years to the manufacturing industries of Taiwan.

Following this, when we inspect the row percentage in each country, it is noted that there are seven items in which the share of investments made in the second period are greater than 50%. They are: the lumber & bamboo products industry (90.9%, with an increase of 890%), the machinery equipments & instruments industry (73.3%, with an increase of 170%), the electronic & electrical appliances industry (64.8%, with an increase of 80%), the basic metals & metal products industry (62.1%, with an increase of 60%), the textiles industry (61.9%, with an increase of 60%), the food & beverage products (61.7%, with an increase of 60%) and the plastic & rubber products industry (52.8%, with an increase of 10%). These indicate that such industries are more and more attractive to the Japanese investors. In other words, they are considered to be the more competitive items of Taiwan nowadays. On the other hand, the shares of

some items have declined. These include the chemicals & chemical products industry (decreased by 60%), the non-metallic mineral products industry (decreased by 60%), the garment & footwear industry (decreased by 70%), the leather & fur products industry (decreased by 70%), and the pulp paper & products industry (decreased by 60%). Other than the chemical industry, these are the traditional industries.

Concerning the column percentages, it is observed that the change in the priority of investment is moderate. The top items remain the same. However, some traditional light industries such as the garment & footwear industry, the lumber & bamboo products industry etc. have found to be less attractive to Japanese investors. On the other hand, the increase in investment on industries like the electronic & electrical appliances industry, the basic metals & metal products industry, the machinery equipments & instruments industry indicates that Taiwan has become more and more competitive in producing these capital-intensive and/or technology-intensive goods. Such changes in the direction of Japanese investments are consistent with the recent development in Taiwan's export trade as we have mentioned in the preceding chapters.

6.4 The Role of Foreign Investment in the ontext of Product Cycle Trade

The concern of the product cycle model is to explain

how new products are innovated and produced in the industrial countries and their exports will expand insofar as a "technological gap" exists between the innovating countries and the "catching up" countries. Over time, foreign productions will be developed as the new products become mature. The initial advantageous export position of the innovating countries is thus threatened, and, one measure to secure foreign markets is by foreign investment. The results in the shift in the location of production.

In fact, the very nature of foreign investment is to help to close the "technological gap" in productions among countries. This is because the content of foreign investment, namely, the "package" therein, contain those important factors for economic development. By this nature, foreign investment is helpful to a developing economy to go over her thresholds of domestic production as well as exportation (as mentioned in Section 1, this chapter). This in turn shortens the period of maturity of new products for starting the domestic productions in a developing country and so leads to an earlier production as well as exportation of the developing country's comparatively advantageous items eventually. In other words, foreign investment provides the force to accelerates the occurrence of product cycle trade.

In our study, Japanese investments made in Taiwan's manufacturing industries are found to be somehow accomodating

her domestic structural changes. As we have revealed in Chapter III, Japan's second structural change, i.e., the "heavy and chemical industrialization", was undertaken in the mid-sixties. And, the records of the Japanese investments indicate that, in those days (which corresponds to the first investment period, 1953-1970, as suggested above), the major items of Japanese investments in Taiwan were mainly those labor-intensive industries. They were, the garment & footweat industry, the leather & fur products industry, the textiles industry (cotton fabrics), the chemicals & chemical products industry (explosives, perfume cosmetics), the non-metallic mineral products industry, as well as the pulp paper & products industry etc. This in turn has led to the occurrence of product cycle trade in the relevant commodities in the earlier days,such as garment & footwear in 1967, cotton fabrics, explosives in 1970, perfume cosmetics, non-metallic products, leather & fur products in 1972 etc.

Then, during the second investment-period, i.e, 1971-1976, corresponds to Japan's endeavors to proceed her third structural change, i.e., the "skill-intensive industrialization", her investment priorities in Taiwan were shifted to those more capital-intensive industries. Such as, the machinery equipments & instruments industry, the electronic & electrical appliances industry, the basic metals & metal products industry,

the textiles industry (made-up textiles), the plastic & rubber products industry etc. Again, this has led to the occurrence of product cycle trade in the relevant commodities recently. They are: the electronic & electrical appliances in 1975, the basic metals & metal products in 1974, the plastic & rubber products in 1972. etc.

Upon such findings, we know that one of the contributions of foreign investment in a developing country is the promotion of the "catching up of product cycles" process. This enables an earlier identification of production opportunities as well as their actual operations, initially to accomodate import-substitution and eventually for export-expansion.

CHAPTER SEVEN: SUMMARY AND CONCLUSION

By incorporating technology into the main factors of production, as well as the essential concern of the location of production, the Product Cycle Model provides a more dynamic approach to interpret the competitiveness in production and exportation of a certain country. Such an approach is considered to be applicable in describing the patterns of trade flows and the process of economic development nowadays.

In the light of such a model, and by using the trade flows data of two closely related trade partners, Taiwan and Japan, the aim of our study is to find out empirical evidences for the existence of product cycle goods as well as their related product cycle trade experiences within the bilateral trade flows of these two countries. At the same time, we also want to gather some information about the actual process that they have undergone, the particulars of relevant intra-industry specialization, and the position of competitiveness etc.

Through our study, a portion of our bilateral commodity flows experience is found to be explainable by the Product Cycle Model. A number of commodities are observed to be product cycle goods where their corresponding product cycle trade experience are detected. These goods are:

SITC group 553 - perfume cosmetic,

571 - explosives,

633 - cork mfs.,

652 - cotton fabrics,

656 - madeup textiles,

661 - lime cement etc.,

665 - glasswares,

666 - pottery,

671 - pig iron etc.,

679 - casting iron & steel,

697 - housewates (metl.),

725 - domestic electric equipments,

831 - handbags etc.,

841 - clothes not fur,

842 - fur clothes etc.,,

893 - plastic mfs. nes.,

894 - toys etc.,

895 - stationery etc.,

899 - mfd. goods nes.

Notably, most of these commodities are labor-intensive mature or standardized products.. Only a few of them are moderately capital-intensive products.

Other than these product cycle goods, there are many commodities showing similar tendency. They are:

SITC group 512 - org. chemicals,

513 - gaseous chemicals,

514 - Inorganic chemicals,

531 - coaltar dyes etc.,

541 - drugs etc.,

599 - chem mat prd nes,

621 - rubber semifnshd,

629 - rubber mfd nes,

641 - paper, paperboard,

642 - paper etc. mfs,

653 - miscel fabrics,

654 - ribbons,

662 - bricks tiles etc.,

653 - mineral mfs nes,

664 - glass,

682 - copper,

683 - nickel,

685 - lead,

694 - nails bolts etc.,

695 - hand tools etc.,

696 - cutlery,

698 - metal mfs nes,

711 - power mach nes,

714 - office machinery,

715 - metalworking mach,

722 - elec power mach,

723 - elec distrib mach,

724 - telecom equipments,

729 - elec mach nes,

731 - railway vehicles,

733 - road veh nes,

861 - instruments etc.,

863 - devd movie film,

864 - watches clocks,

891 - music instru etc.,

892 - printed matter.

Different from the nineteen product cycle goods, the above listed goods require generally more inputs of capital and/or technology for their productions.

Then, our intra-industry trade analysis shows that, the commodities in trade between Taiwan and Japan are characterized by the difference of their versions. Taiwan's exportables are found to be mainly those common versions whilst Japan's exportables are those more sophisticated versions. Moreover, by this analysis, Taiwan's trade development endeavors are observed to be that of intra-industry expansion rather than inter-industry expansion.

In addition, hoping that our analyses may eventually be interpreted by the Law of Comparative Advantage, we employed the "Revealed Comparative Advantage" test to inspect the position of competitiveness of the products. As a whole,

the found product cycle goods are noted to be more competitive (with an average RCA index of 298.8) than those cyclical trend observed goods (average RCA index = 70.6) in the Japanese market.

Finally, an investigation of the foreign investments in Taiwan's manufacturing industries was taken. It is noted that, the making of foreign investment is sensitive to the host country's comparative advantage position. And, upon a more detailed inspection of the Japanese investments in particular, it shows that, Japanese investments are made to accomodate her own structural changes. This in turn promotes the shift of the location of production. At the same time, close inter-relationship is found between the Japanese investment priorities and the timing of occurrence of the corresponding product cycle trade. In other words, this shows that foreign investments do facilitate the emergence of product cycle trade.

All our findings indicate that the product cycle approach is useful in depicting the pattern of trade flows between two steady stages (or, equilibrium positions) in the life cycles of the manufactured products. At the beginning, the initial steadiness of trade pattern (governed by the Law of Comparative Advantage) was disturbed by a technological breakthrough which brought about a new product. In those days, the technology abundant innovators possessed the advantageous position in the

Production and exportation of such a product. As time went on, the capital abundant producers (mainly found in the industrial countries) would acquire comparative advantage in the production and exportation of the by now newly mature product. This in turn led to a shift of the location of production from the innovating country to the industrial countries. Then, when the product has become mature or standardized, its location of production would be determined once again by the Law of Comparative Advantage. Henceforth, the capital abundant countries would have comparative advantage in the production and exportation of those capital-intensive mature or standardized products whilst the labor abundant countries would be competitive in the production and exportation of the labor-intensive mature or standardized products. Trade pattern and the location of production would adjust accordingly.

Other than the evolution in a product's life and its corresponding location of production and trade pattern, the industrial structure of a country will change with its pace of economic development. Owing to the accumulation of capital stock, the progress in technology, and the rise in wages, the competitiveness in production and exportation of a country will not be constant over time. A country which has at present competitive position in, say, labor-intensive products, may lose it gradually. On the other hand, this country may acquire comparative advantage in, say, capital-

intensive products in step with its economic development later on. In our case, some newly mature products which require more capital and/or technology inputs have become more and more important in Taiwan's exports. Indeed, industrial structural changes also lead to changes in the scope of product cycle trade, from the initial labor-intensive products to the capital-intensive products and so on.

Upon these findings, we realize that, the product cycle model serves to provide a framework that helps in scanning for products that are likely candidates of domestic production and exportation. For instance, in our case, Taiwan is now not so competitive in the production and exportation of some labor-intensive goods whilst gaining advantageous position in the production and exportation of those more capital-intensive goods. So, it is expected that those capital-intensive goods showing cyclical tendency will become prosperous industries in the coming days. However, to implement this, Taiwan needs to absorp modern technologies extensively, and, positive plannings must be carried out in order to train various managerial personnels and skill labors. At the same time, her trade development should be promoted towards more "product differentiation" so that the benefits of intra-industry specialization can be realized. These efforts, indeed, will lead to the securing

of Taiwan's competitiveness in the production and exportation of more capital-intensive mature or standardized products, and if possible, in the technology-intensive new products in the days to come, as what Japan has managed to.

STATISTICAL APPENDICES

Appendix 4.1

Trade Figures of Taiwan-Japan Bilateral Commodity Flows
1954 - 1975

(Unit : US$1,000)

SITC Section	1954 X	1954 M	1955 X	1955 M	1956 X	1956 M
0	17,373	2,523	26,139	1,105	23,941	1,211
1	---	---	---	---	2	1
2	607	130	1,206	380	1,743	2,326
3	1	1	124	98	286	227
4	---	17	---	64	10	121
5	135	7,709	176	8,098	414	15,087
6	81	4,328	84	7,181	832	11,645
7	---	5,241	---	5,713	1	11,117
8	49	486	177	846	23	1,646
9	---	---	11	25	7	42
All	18,247	20,436	27,917	23,510	27,257	43,423

(Unit : US$1,000)

SITC Section	1957 X	1957 M	1958 X	1958 M	1959 X	1959 M
0	30,249	912	38,183	563	53,887	1,171
1	---	---	---	---	2	---
2	1,212	2,858	1,574	1,483	3,451	2,606
3	512	246	295	150	571	391
4	12	48	60	34	140	259
5	232	11,091	237	22,945	920	31,238
6	120	12,820	109	14,790	193	21,787
7	---	13,689	---	13,554	---	23,441
8	45	1,717	19	1,801	10	3,781
9	2	69	1	138	4	192
All	32,386	43,448	40,433	55,457	59,178	84,865

(Unit : US$1,000)

SITC Section	1960 X	1960 M	1961 X	1961 M	1962 X	1962 M
0	49,135	2,150	47,697	2,402	43,971	1,929
1	1	11	6	---	3	---
2	4,895	3,074	4,126	6,388	5,072	8,706
3	1,106	828	1,767	906	834	1,168
4	97	1,039	80	1,201	175	---
5	1,797	11,804	2,198	20,643	1,264	22,939
6	52	23,599	325	25,238	256	33,280
7	---	34,996	9	35,113	20	45,584
8	25	4,306	206	5,288	442	4,884
9	3	277	---	360	---	---
All	57,111	82,084	56,413	97,540	52,037	118,585

Appendix 4.1
(Cont.)

(Unit : US$1,000)

SITC Section	1963 X	1963 M	1964 X	1964 M	1965 X	1965 M
0	92,273	1,753	117,989	2,295	121,221	2,694
1	4	---	3,269	---	8	---
2	8,196	10,897	12,750	15,132	12,546	14,298
3	644	698	770	1,867	8	1,851
4	194	451	107	162	166	---
5	2,573	22,476	2,035	20,538	2,037	32,797
6	339	31,381	721	47,123	607	67,409
7	---	34,883	23	44,643	147	89,319
8	753	4,580	902	5,595	968	8,572
9	6	---	11	534	15	920
All	105,231	107,151	138,577	137,902	137,723	217,933

(Unit : US$1,000)

SITC Section	1966 X	1966 M	1967 X	1967 M	1968 X	1968 M
0	102,216	3,448	83,939	4,979	89,965	6,986
1	13	---	25	588	99	925
2	19,818	14,643	18,663	16,840	18,247	21,700
3	2,020	1,863	1,929	2,011	2,030	2,612
4	60	292	44	310	35	118
5	1,864	39,178	2,215	41,859	1,624	56,088
6	1,012	84,962	3,731	103,707	9,916	127,856
7	827	100,031	1,471	143,658	2,267	233,984
8	939	9,689	2,304	13,029	3,462	17,839
9	109	1,247	178	1,200	213	3,557
All	128,871	255,398	114,498	328,180	127,856	471,664

(Unit : US$1,000)

SITC Section	1969 X	1969 M	1970 X	1970 M	1971 X	1971 M
0	95,200	10,459	93,410	12,922	121,496	17,922
1	92	---	174	---	411	145
2	18,331	27,522	37,610	39,126	34,261	69,688
3	2,790	3,301	2,747	3,823	2,320	5,443
4	34	176	68	484	65	1,248
5	2,078	66,552	3,031	72,682	4,894	122,308
6	12,004	170,971	36,095	208,476	27,635	300,544
7	8,499	300,512	17,212	321,956	16,752	479,899
8	8,122	22,947	25,293	31,459	36,191	43,021
9	227	3,917	448	9,508	285	7,482
All	147,377	606,406	216,087	700,474	244,311	1,047,702

Appendix 4.1
(Cont.)

(Unit : US$1,000)

SITC Section	1972 X	1972 M	1973 X	1973 M	1974 X	1974 M
0	167,577	20,775	266,281	33,243	272,745	37,069
1	592	105	920	103	1,913	112
2	56,051	71,137	66,678	118,331	49,070	111,055
3	5,739	5,905	6,568	11,633	4,957	26,001
4	34	1,012	38	792	243	2,210
5	7,274	154,359	18,304	202,851	32,566	260,783
6	56,650	317,872	198,091	501,212	138,420	645,689
7	25,541	458,019	53,403	658,927	79,880	795,235
8	56,945	55,209	173,428	93,306	219,310	103,484
9	891	6,214	521	14,634	591	21,219
All	377,294	1,090,616	784,224	1,635,031	799,695	2,002,857

(Unit : US$1,000)

SITC Section	1975 X	1975 M
0	296,676	45,083
1	2,614	133
2	50,014	104,788
3	3,337	23,913
4	506	2.087
5	21,088	389,374
6	77,070	496,068
7	73,094	646,459
8	149,553	98,416
9	69	17,977
All	674,021	1,824,298

Source : 1954 to 1961 data - Given by a friend who lives in Taipei.
1962 to 1970 data - Commodity Trade Statistics, United Nations.
1971 to 1975 data - Japan Exports and Imports.

Note : X - Exports of Taiwan to Japan,
M - Imports of Taiwan from Japan.

Appendix 4.3

Trade Figures of Taiwan-Japan Bilateral Commodity Flows at 3-digit level of SITC 5-8 sections in Selected Years

(Unit : US$1,000)

SITC Code	1962 X	1962 M	1970 X	1970 M	1975 X	1975 M
512	---	1,826	562	18,360	21,068	336,169
513	---	413	---	4,820	1,383	38,918
514	---	677	---	3,744	1,461	35,021
515	---	---	---	---	26	235
521	---	---	---	---	---	1,834
531	---	685	---	3,481	1,466	30,426
532	---	---	---	---	54	410
533	---	606	---	3,224	---	50,828
541	---	4,968	212	5,824	16,115	30,127
551	1,191	---	2,227	892	6,505	4,573
553	---	---	---	---	436	125
554	---	242	---	2,504	28	20,774
561	---	9,516	---	807	---	62,421
571	---	542	117	---	3,343	34
581	---	1,986	---	21,261	1,040	313,728
599	---	1,345	---	7,477	4,568	60,788
611	---	---	---	3,014	541	52,783
612	---	---	646	320	3,405	656
613	---	---	---	---	58	52
621	---	---	---	891	306	4,823
629	---	286	---	1,097	2,899	8,989
631	---	---	14,257	---	22,696	733
632	---	---	2,089	---	89,263	540
633	---	---	---	---	24	---
641	---	974	---	3,873	2,124	33,848
642	---	684	---	1,053	682	1,674
651	---	4,396	7,007	27,952	16,934	86,624
652	---	507	5,800	1,644	24,096	10,506

Appendix 4.3
(Cont.)

(Unit:US$1,000)

SITC Code	1962 X	1962 M	1970 X	1970 M	1975 X	1975 M
653	---	792	1,376	24,564	14,132	113,063
654	---	---	---	457	1,443	4,097
655	---	780	463	3,218	3,172	24,310
656	---	---	324	177	12,631	499
657	---	---	565	---	10,920	234
661	---	---	391	227	10,526	2,727
662	---	146	146	844	631	3,423
663	---	364	227	1,720	2,263	12,070
664	---	---	112	1,626	2,087	10,152
665	---	---	---	122	2,515	613
666	---	160	---	395	526	395
667	---	---	---	---	601	1,986
671	---	---	490	181	25,404	9,499
672	---	---	---	4,053	523	92,566
673	---	2,443	2,135	13,373	223	137,876
674	---	9,926	---	59,411	---	361,069
675	---	1,881	---	5,178	---	29,107
676	---	---	---	1,395	---	1,779
677	---	1,026	---	3,158	---	19,274
678	---	2,975	247	5,378	1,433	99,806
679	---	---	---	---	687	685
681	---	---	---	319	44	52,785
682	---	2,446	1,366	16,703	4,963	78,874
683	---	---	---	333	130	4,236
684	---	---	512	988	2,035	14,990
685	---	---	---	368	633	2,319
686	---	---	---	2,001	---	16,243
687	---	---	---	571	---	1,041
689	---	---	---	598	11	4,583
691	---	120	---	4,014	1,029	61,704

Appendix 4.3
(Cont.)

(Unit : US$1,000)

SITC Code	1962 X	1962 M	1970 X	1970 M	1975 X	1975 M
692	---	103	---	790	155	11,208
693	---	152	---	515	127	7,114
694	---	---	---	1,063	303	7,317
695	---	1,418	---	5,552	1,246	27,956
696	---	---	---	363	71	1,479
697	---	---	---	168	3,061	833
698	---	887	432	6,508	7,906	47,561
711	---	2,879	113	11,812	3,029	95,189
712	---	1,454	---	1,216	115	26,709
714	---	173	1,778	4,546	15,765	32,431
715	---	399	204	8,442	3,307	74,278
717	---	3,797	---	31,811	2,088	117,662
718	---	1,538	193	7,972	1,005	62,660
719	---	5,781	276	48,556	5,725	350,871
722	---	3,279	2,645	27,298	24,358	171,323
723	---	561	---	7,562	10,860	38,403
724	---	3,396	3,518	50,440	59,318	194,864
725	---	212	---	1,824	9,663	4,358
726	---	---	---	455	---	4,782
729	---	3,362	9,224	46,321	101,345	340,534
731	---	702	---	12,364	309	4,126
732	---	11,994	---	21,311	1,316	313,594
733	---	277	---	1,302	572	10,210
734	---	---	---	1,397	---	32
735	163	5,687	---	27,328	794	75,217
812	---	---	473	493	269	1,664
821	---	---	223	110	50,535	877
831	---	---	165	---	8,927	221
841	---	---	16,946	---	206,410	1,202

Appendix 4.3
(Cont.)

(Unit : US$1,000)

SITC Code	1962 X	1962 M	1970 X	1970 M	1975 X	1975 M
842	---	---	---	---	110	40
851	---	---	1,427	---	57,089	129
861	---	1,699	804	9,294	30,032	92,234
862	---	556	---	2,278	---	19,448
863	---	204	102	197	50	216
864	---	525	1,490	4,975	17,365	64,765
891	---	444	---	9,182	9,723	76,730
892	---	356	233	1,188	5,644	5,871
893	---	---	204	635	11,414	6,213
894	---	---	1,184	1,189	31,333	17,392
895	---	296	381	359	4,041	3,855
896	---	---	181	---	1,758	31
897	---	---	130	---	5,676	939
899	---	486	2,825	1,212	33,711	8,879

Source : Commodity Trade Statistics, United Nations, 1962,1970; Japan Exports and Imports, Dec.1975.

Note : X - Exports of Taiwan to Japan,
M - Imports of Taiwan from Japan.

Appendix 4.4

Trade Figures of the Product Cycle Commodities
1962 to 1975

(Unit : US$1,000)

SITC Code	1962 X	1962 M	1963 X	1963 M	1964 X	1964 M
553	---	---	---	---	---	---
571	---	542	---	253	---	---
633	---	---	---	---	---	---
652	---	507	---	485	---	223
656	---	---	---	---	---	---
661	---	---	---	---	---	---
665	---	---	---	---	---	---
666	---	160	---	---	---	130
671	---	---	---	---	---	---
679	---	---	---	---	---	---
697	---	---	---	---	---	---
725	---	212	---	912	---	1,339
831	---	---	---	---	---	---
841	---	---	---	---	---	---
842	---	---	---	---	---	---
893	---	---	---	---	---	116
894	---	---	---	---	---	---
895	---	296	---	215	---	253
899	---	486	256	539	293	160

Source : 1962 data - No. 21, Vol 12, Commodity Trade Statistics,
1963 data - No. 19, Vol 13, Commodity Trade Statistics,
1964 data - No. 21, Vol 14, Commodity Trade Statistics.

Note : X - Exports of Taiwan to Japan,
M - Imports of Taiwan from Japan.

Appendix 4.4
(Cont.)

(Unit : US$1,000)

SITC Code	1965 X	1965 M	1966 X	1966 M	1967 X	1967 M
553	---	---	---	---	---	---
571	---	---	---	822	---	278
633	---	---	---	---	---	---
652	---	156	---	282	656	626
656	---	---	---	161	---	---
661	---	---	---	---	---	---
665	---	---	---	---	---	---
666	---	---	---	113	---	194
671	---	---	---	238	176	409
679	---	---	---	---	---	---
697	---	---	---	---	---	---
725	---	1,184	---	772	---	915
831	---	---	---	---	---	---
841	---	---	129	741	741	---
842	---	---	---	---	---	---
893	---	165	---	198	---	211
894	---	101	---	171	---	194
895	---	283	---	220	137	218
899	364	1,141	395	256	755	432

Source : 1965 data - No.19, Vol 15, Commodity Trade Statistics,
1966 data - No.22, Vol 16, Commodity Trade Statistics,
1967 data - No.28, Vol 17, Commodity Trade Statistics.

Note : X - Exports of Taiwan to Japan,
M - Imports of Taiwan from Japan.

Appendix 4.4
(Cont.)

(Unit : US$1,000)

SITC Code	1968 X	1968 M	1969 X	1969 M	1970 X	1970 M
553	---	---	---	---	---	---
571	---	192	---	---	117	---
633	---	---	---	---	---	---
652	2,628	487	2,906	830	5,800	1,644
656	---	263	---	---	324	177
661	---	---	---	238	391	227
665	---	---	---	---	---	122
666	---	---	---	489	---	395
671	---	212	---	247	490	181
679	---	---	---	---	---	---
697	---	---	---	155	---	168
725	---	1,203	---	1,320	---	1,824
831	---	---	---	103	165	---
841	1,387	---	3,017	---	16,946	---
842	---	---	---	---	---	---
893	---	361	143	573	204	635
894	---	425	278	519	1,184	1,189
895	---	219	---	357	381	359
899	1,019	715	1,295	898	2,825	1,212

Source : 1968 data - No.27, Vol 18, Commodity Trade Statistics,
1969 data - No.36, Vol 19, Commodity Trade Statistics,
1970 data - No.41, Vol 20, Commodity Trade Statistics.

Note : X - Exports of Taiwan to Japan,
M - Imports of Taiwan from Japan.

Appendix 4.4
(Cont.)

(Unit : US$1,000)

SITC Code	1971 X	1971 M	1972 X	1972 M	1973 X	1973 M
553	8	24	42	41	91	35
571	304	142	245	61	829	24
633	3	9	---	56	4	42
652	9,341	3,221	16,462	1,277	29,986	3,655
656	916	159	2,319	184	9,299	291
661	459	203	1,116	124	5,973	188
665	71	184	163	303	424	345
666	16	380	70	222	294	375
671	182	1,234	1,000	1,218	612	3,147
679	41	74	68	165	92	146
697	62	172	282	133	1,471	158
725	140	2,243	666	1,226	935	1,890
831	243	398	700	572	1,451	895
841	28,356	135	30,757	172	112,496	300
842	11	38	14	44	137	69
893	921	1,102	1,442	1,432	3,679	2,485
894	2,098	1,781	4,754	2,262	10,154	3,137
895	285	449	560	523	364	647
899	6,085	2,054	6,715	2,660	13,416	3,617

Source : 1971 data - Japan Exports & Imports, Dec. 1971,
1972 data - Japan Exports & Imports, Dec. 1972,
1973 data - Japan Exports & Imports, Dec. 1973.

Note : X - Exports of Taiwan to Japan,
M - Imports of Taiwan from Japan.

Appendix 4.4
(Cont.)

(Unit : US$1,000)

SITC Code	1974 X	1974 M	1975 X	1975 M
553	188	59	436	125
571	1,396	55	3,343	34
633	2	5	24	---
652	9,180	2,784	24,096	10,506
656	10,842	348	12,631	499
661	4,278	353	10,526	2,727
665	1,124	389	2,515	613
666	198	411	526	396
671	6,096	1,449	25,404	9,499
679	533	285	687	685
697	2,348	415	3,061	833
725	1,425	2,968	9,663	4,358
831	1,750	402	8,927	221
841	136,109	924	206,410	1,202
842	85	82	110	40
893	7,268	2,608	11,414	6,213
894	13,414	3,526	31,333	8,696
895	476	895	4,041	3,855
899	13,560	3,571	33,711	8,879

Source : 1974 data - Japan Exports & Imports, Dec.1974,
1975 data - Japan Exports & Imports, Dec.1975.

Note : X - Exports of Taiwan to Japan,
M - Imports of Taiwan from Japan.

BIBLIOGRAPHY

1. Akamatsu, K.,
" A Historical Pattern of Economic Growth in Developing Countries ", The Developing Economics, 1962, pp. 3-25.

2. Balassa, Bela,
" Trade Liberalization and Revealed Comparative Advantage ", Manchester School of Economic & Social Studies, Vol. 36, No. 2, pp. 99-123.

3. ----------,
" Tariff Reduction and Trade in Manufactures among the Industrial Countries ", American Economic Review, June 1966, pp. 466-473.

4. Clark, G.,
" An Analysis of Japanese Direct Investment Overseas in Postwar Years ", The Developing Economics, No. 1, 1971, pp. 58-64.

5. De la Torre Jr., Jose R.,
" Marketing Factors in Manufactured Exports from Developing Countries ", in L.T. Wells Jr. ed., The Product Life Cycle and International Trade, Harvard University Press, 1972, pp. 227-245.

6. Douglass, Gorden K.,
" Product Variation and International Trade in Motion Pictures ", Doctoral Dissertation, M.I.T., 1963.

7. Finger, J.M.,
" A New View of the Product Cycle Theory ", Welwirtschaftliches Archiv, 1975, pp. 79-99.

8. Grubel, H.G.,
" Intra-Industry Specialization and Pattern of Trade ", Canadian Journal of Economics & Political Science, August 1967, pp. 374-388.

9. ----------,
" The Theory of Intra-Industry Trade ", in I.A. McDougall & R.H. Snape ed., Studies in International Economics, North-Holland, Amsterdam, 1970, pp. 35-51.

10. Grubel, H.G. & Lloyd, P.J.,
Intra-Industry Trade, London : Macmillan, 1975.

11. ----------,
" The Empirical Measurement of Intra-Industry Trade ", Economic Record, Dec. 1971, pp. 494-517.

12. Gruber, W., Mehta, D. & Vernon R.,
" The R & D Factor in International Trade and International Investment of U.S. Industries ", Journal of Political Economy, Feb. 1967, pp. 20-37.

13. Haberler, Gottfreid,
" International Trade and Economic Development ", in James D. Theberge ed., Economics of Trade and Development, New York : John Wiley & Sons Co., 1968, pp. 103-112.

14. Hirsch, Seev,
" Hypotheses Regarding Trade Between Developing and Industrial Countries ", in H. Giersch, Tubingen & Mohr ed., The International Division of Labor : Problem and Perspectives, Herbert briersch Institute fur Weltwirtshaft Kiel, 1974, pp. 65-82.

15. Hirsch, Seev,
" The U.S. Electronic Industry in International Trade ", National Institution Economic Review, Nov. 1965, pp. 92-97.

16. ----------,
Location of Industry and International Competitiveness, Oxford 1967.

17. Hirschman, Alber O.,
The Strategy of Economic Development, New Haven, Conn., Yale University Press, 1958.

18. Hsing, Mo-huan,
Taiwan : Industrialization and Trade Policies, Oxford University Press, London 1971.

19. ----------,
The Development Experience of Taiwan & South Korea : A Comparison , Economic Research Centre, C.U.H.K., 1974.

20. Hufbauer, G.C.,
Synthetic Materials and the Theory of International Trade, London : Gernald Duckworth & Co., 1965.

21. ----------,
" The Impact of National Characteristics and Technology on the Commodity Composition of Trade in Manufactured Goods ", in R. Vernon ed., The Technology Factor in International Trade, Columbia University Press, 1970.

22. Kindleberger, C.P.,
Foreign Trade and the National Economy, Yale University Press, 1962.

23. Klein, R.W.,
" A Dynamic Theory of Comparative Advantage ", American Economic Review, Vol. 63, 1973, pp. 173-184.

24. Kojima, Kiyoshi,
Japan and a Pacific Free Trade Area, London : Macmillan, 1971.

25. ----------,
" The Japanese Experience and Attitude Toward Trade Adjustment ", in The Prospect for Partnership, World Bank Publication, 1973, pp. 228-259.

26. Kravis, I.,
" Availability and other Influences on the Commodity Composition of Trade ", Journal of Political Economy, 1956, pp. 143-155.

27. Lary, Hal B.,
" Changing Patterns of International Comparative Advantage ", National Bureau of Economic Research, 1969, pp. 27-36.

28. Leontief, W.W.,
" Domestic Production and Foreign Trade : The American Capital Position Re-examined ", Economia Internazionale, Feb. 1954, pp. 9-38.

29. Liao S-k,
" An Analysis of Export Growth and Trade Flows of Hong Kong ", Master Thesis, C.U.H.K., 1977.

30. Linder, S.B.,
An Essay on Trade and Transformation, New York : John Wiley & Sons, 1961.

31. Luey, Paul,
" Inter-Industry Specialization in International Trade : The Hong Kong Case ", Hong Kong Economic Papers, No. 11, April 1977, pp. 20-41.

32. Marshall, Alfred,
Industry and Trade, London : Macmillan, 1920,

33. Meier, G.M.,
" Private Foreign Investment ", in John H. Dunning ed., International Investment, Penguin Modern Economics Readings, 1972, pp. 412-435.

34. Minhas, B.S.,
" The Homohypallagic Production Function, Factor-Intensity Reversals and the Heckscher-Ohlin Theorem ", Journal of Political Economy, Vol. 70, 1962, pp. 138-156.

35. Murakami, Atsushi,
" Economic Policies of Japan toward Southeast Asian Developing Countries ", in Soo-ann Lee ed., New Directions in the International Relations of Southeast Asia, Economic Relations, pp. 54-66.

36. Nurkse, Ragner,
" Pattern of Trade and Development ", in James D. Theberge ed., Economics of Trade and Development, New York : John Wiley & Sons Co., 1968, pp. 85-102.

37. Posner, M.V.,
" International Trade and Technical Change ", Oxford Economic Papers, Oct. 1961, Vol. 13, pp. 323-341.

38. Robertson, D.H.,
Essays in Monetary Theory, London : Staple, 1956.

39. Stobaugh, Robert B.,
" The Neo-Technology Account of International Trade : The Case of Petro-Chemicals ", in L.T. Wells Jr. ed., The Product Life Cycle and International Trade, Harvard University Press, 1972, pp. 83-99.

40. Tatemoto, M. Ichimura,
" Factor Proportions and Foreign Trade - The Case of Japan ", Review of Economics and Stattistics, Nov. 1959.

41. Todaro, Michael P.,
Economics for a Developing World, London : Longmans, 1977.

42. Tsurumi, Yoshihiro,
" R & D Factors and Exports of Manufactured Goods of Japan ", in L.T. Wells Jr. ed., The Product Life Cycle and International Trade, Harvard University Press, 1972, pp. 161-179.

43. Vernon, Raymond,
" International Investment and International Trade in the Product Cycle ", Quarterly Journal of Economics, Vol. 80, 1966, pp. 190-207.

44. ----------,
" The Location of Economic Activity ", in John H. Dunning ed., The Economic Analysis and the Multinational Enterprise, London : Allen & Unwin, 1971, pp. 89-114.

45. Wells Jr., Louis T.,
" A Product Life Cycle for International Trade ? ", Journal of Marketing, Vol. 32, July 1968, pp. 1-6.

46. ----------,
" Test of a Product Cycle Model of International Trade: U.S. Exports of Consumer Durables ", Quarterly Journal of Economics, Feb. 1969, pp. 152-162.

47. ----------,
" International Trade - The Product Cycle Approach ", in L.T. Wells Jr. ed., The Product Life Cycle and International Trade, Harvard University Press, 1972, pp. 3-37.

48. Yoshihara, Kunno,
Japanese Direct Investment in Southeast Asia, Institute of Southeast Asian Studies, Singapore, 1973.